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December, 1922

Number 5

TECHNICAL PUBLICATION NO. 16
OF
NEW YORK STATE COLLEGE OF FORESTRY
AT
SYRACUSE UNIVERSITY

F. F. MOON, Dean

Papers from the Department of Forest Entomology .



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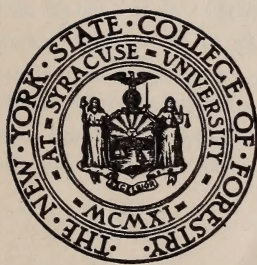
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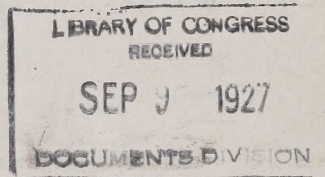


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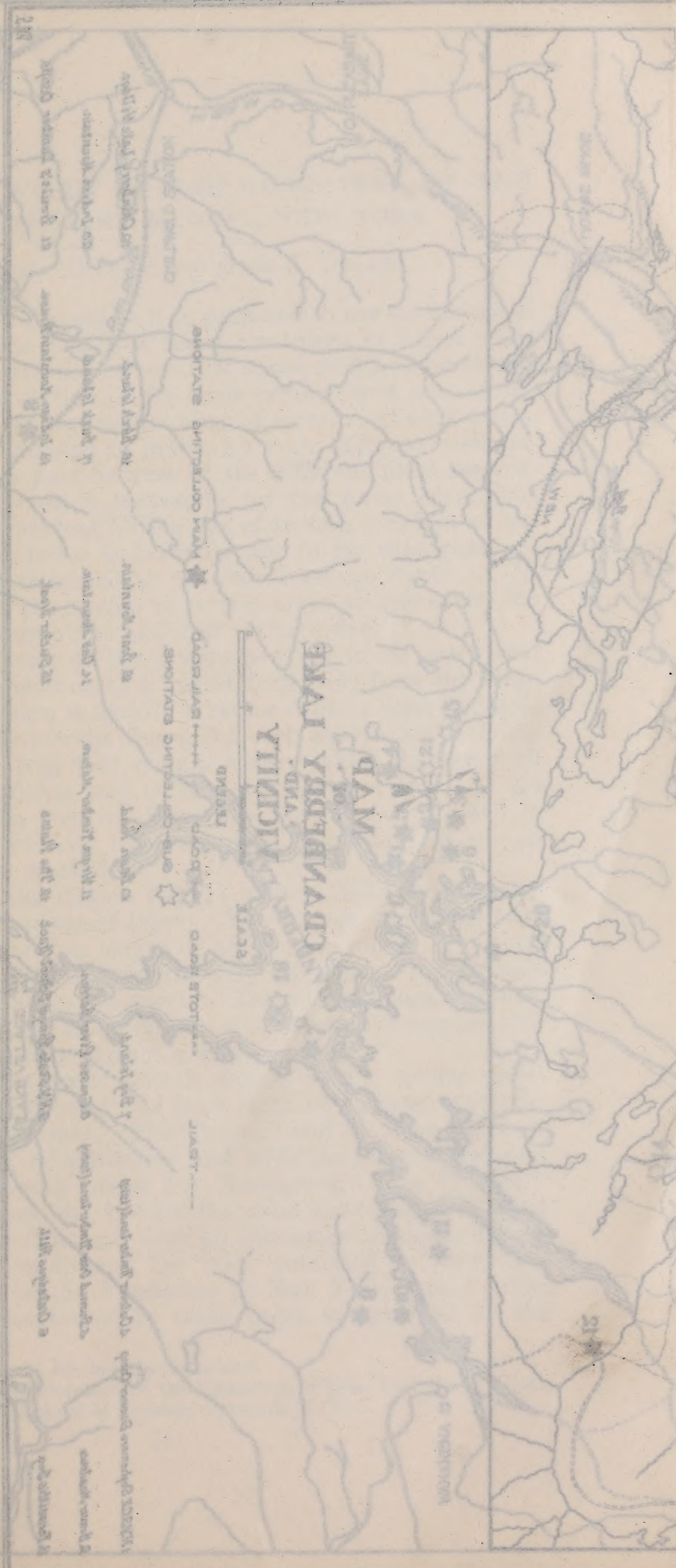
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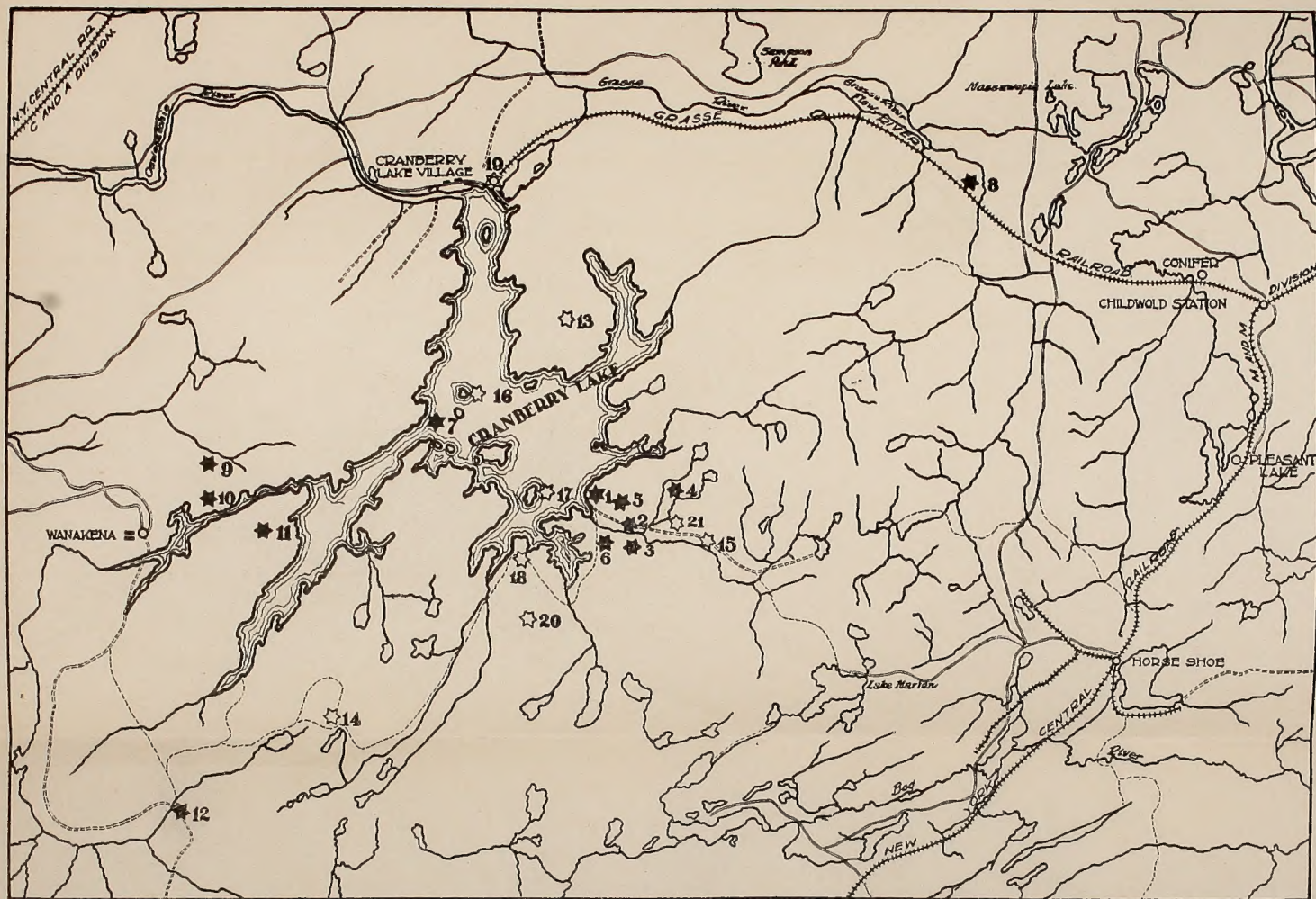
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Fig. 1. Map of the Campbell Lake Region, New York, showing the location of Collection Station. (From R. S. Miller)







MAP
OF
CRANBERRY LAKE
AND
VICINITY

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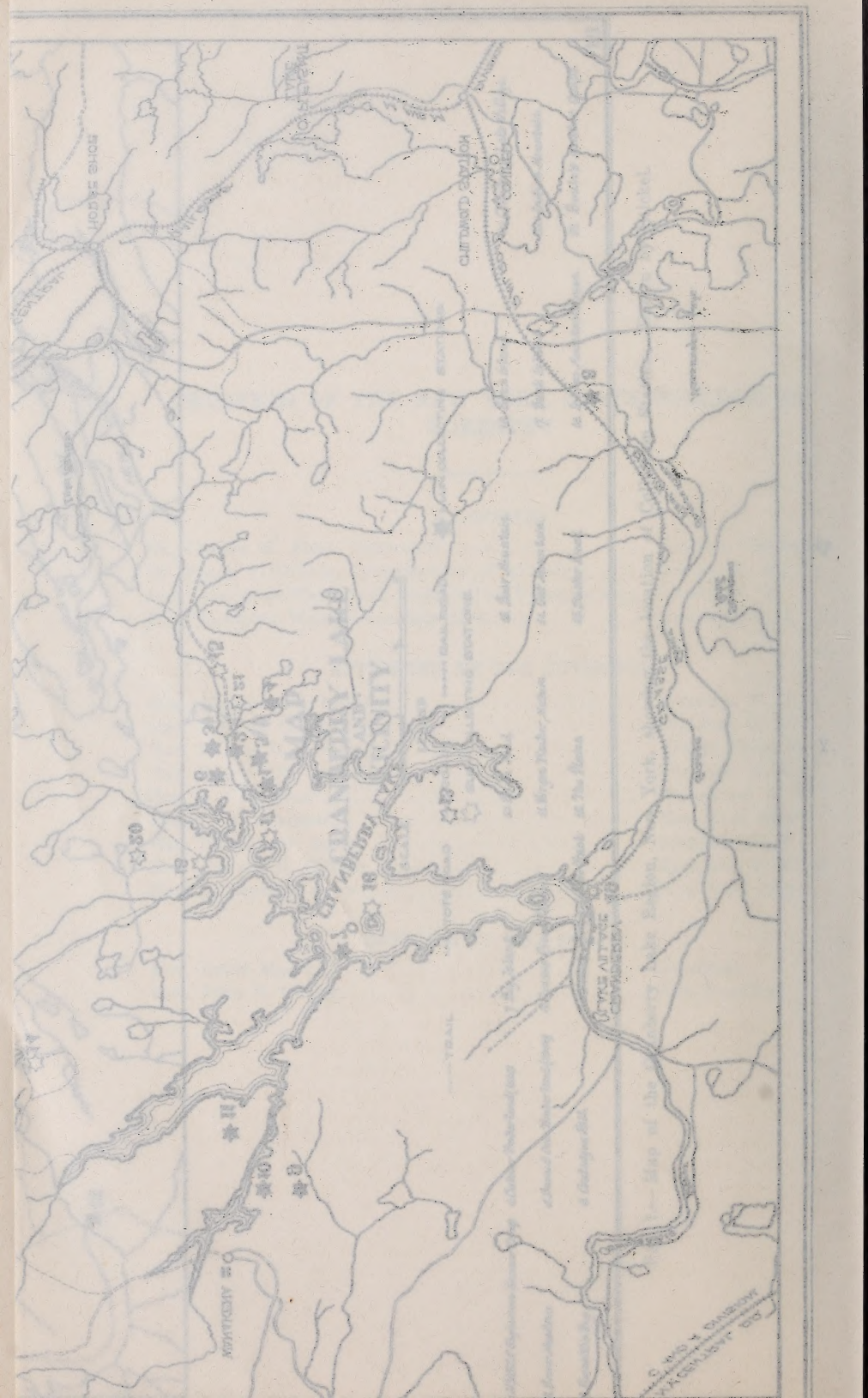
LEGEND

--- TRAIL --- TOTE ROAD --- ROAD +++ RAILROAD ★ MAIN COLLECTING STATIONS.
★ SUB-COLLECTING STATIONS.

- | | | | | | | |
|------------------------------|---------------------------------|----------------------------------|--------------------------|------------------|--------------------------|---------------------------|
| 1 NYSGE Stephano Summer Camp | 4 Outover Timberland (1913) | 7 Bog Island | 10 Bear Pond | 13 Bear Mountain | 16 Birch Island | 19 Cranberry Lake Village |
| 2 Beaver Meadows | 5 Burned Over Timberland (1900) | 8 Grasse River Barren | 11 Virgin Kinder, Mature | 14 Oak Mountain | 17 Buck Island | 20 Indian Mountain |
| 3 Foxsills Bog | 6 Catskills Hill | 9 N.Y. State Sanger School Tract | 12 The Plains | 15 Sucker Brook | 18 Indian Mountain House | 21 Boul's Lumber Camps |

D.S.

Fig. 1.—Map of the Cranberry Lake Region, New York, showing the location of Collection Station. Drawn by Stickel.



AN ECOLOGICAL STUDY OF THE HEMIPTERA OF THE CRANBERRY LAKE REGION, NEW YORK

BY HERBERT OSBORN AND CARL J. DRAKE

For the purpose of this study it is proposed to use an ecological grouping based on the primitive forest conditions or forest cover of the region with particular recognition of the modification caused by the lumbering or cutting of the large conifers and part of the hardwoods, and the subsequent burning of certain cut-over tracts. These factors have operated to produce a very different combination of organisms, in part because of the different plant associations which have formed a succession for the forest cover, but largely owing to the evident killing out of certain members of the original fauna. The latter is probably due to the disappearance of the food plants concerned or in some cases no doubt to the actual elimination of the species in certain areas occasioned by the destruction of the vegetation and duff through fire.

While the boundaries of the groups are not in all cases well defined, and as each may carry a varied flora aside from the dominant plant species, there is usually a rather definite limit for each. In any case the hemipterous fauna for each association is fairly well defined. It is true that certain species which disregard all limitations of host plants may enter a number or even all of the communities, but this does not invalidate the general rule and in many cases the restrictions to certain host plants or to a special environment is very marked.

The Cranberry Lake Region (fig. 1) as here delimited includes the lake proper and adjacent tracts. The former, including bays and flows, has a maximum length of about nine miles. The total distance around the lake is approximately 160 miles. The altitude is about 1,485 feet above sea level.* The valleys, bogs, swamps, lakes, marshes, streams, hills and low mountains give considerable physiographical diversity within a small area.

The original forest cover (birch, beech, maple, spruce, pine, hemlock, balsam, larch, etc.) has been modified in most tracts by lumbering and fire (burns). The "burns" and cut-over areas are in various stages of rehabilitation and offer the most varied and most favorable breeding places for Hemiptera. The "plains," bogs, swamps, marshes, etc., present the usual combination of plant association. An excellent and detailed discussion of these, including the biological conditions, has been published by Bray† in "The Development of the Vegetation of New York State." The collecting regions mentioned in these pages are marked by the

* The camp site is about 1,500 feet above sea level.

† Bray, W. L. The Development of the Vegetation of New York State. Tech. Pub. No. 3, N. Y. State College of Forestry, Syracuse, N. Y.

absence of oak, sycamore, hickory, walnut, hackberry, elm and basswood.

Headquarters were established at the State Forest Camp on Barber Point, Cranberry Lake, about seven miles from Cranberry Village and some eight miles from Wanakena. The collections covered a diversity of locations and the paper is based on records of three summers, collections being made at odd times by Drake in 1917 and 1919 and the past summer (1920) by Osborn and Drake together.

For convenience the list of species follows the excellent catalogue by Van Duzee,* but in many cases the authors do not consider the sequence of genera or species as representing the most probable lines of evolution of the groups or the natural affinities. No synonymy or specific bibliography has been included since these are so admirably covered by the above mentioned author. Only references to the more recent papers or to such as are especially desirable for the accommodation of readers of this paper are cited.

LOCATION OF COLLECTING STATIONS

1. **State Forest Camp** (Fig. 2): The principal collecting station was the state forest camp and other of the more favorable areas in the immediate vicinity. In fact about 95 per cent of the species herein listed were recorded for the Barber tract. The different associations of this area are quite representative of the Cranberry Lake region and includes forests, swamps, marshes, bogs, hills, flows, tote-roads, trails, burns, and streams.



Fig. 2.—State Forest Camp Site of the New York State College of Forestry, Barber Point, Cranberry Lake, N. Y. See description of Station Number 1. Photo by Osborn.

* Van Duzee, E. P. Cat. Hemip. of Amer. North of Mexico. Univ of Calif. Pub., Vol. II, pp. I-XIV, 1-902, 1917.



Fig. 3.—The Beaver Meadow on the Barber Tract. See description of Station Number 2. Photo by Dr. Bray.

In addition to the native plants several foreign species, incidentally carried in with the hay and grain destined for the lumber camps, have become established along the trails and tote-roads. One of the latter almost parallels Sucker Brook and leads through various ecological types, including bogs, beaver meadows, logged area, etc., to Proulx's lumber camp and offered the most favorable and attractive collecting places.

2. **Beaver Meadows** (Fig. 3): The beaver meadows are located about a mile from the State Forest Camp along the Sucker Brook tote-road. As the name suggests, these extensive areas have arisen through flooding occasioned by the beaver dams and have replaced a balsam swamp forest which preceded them. As a result of this inundation the balsam (*Abies balsamea* (L) Mill.), spruce (*Picea rubra* (DuRoi) Dietr.), speckled alder (*Alnus incana* (L) Moench.) and many of the other woody and non-woody plants have been smothered by the higher water level. The dominant plants of the present association, which persist around the borders and on the higher elevations, are grasses (principally *Calamagrostis canadensis* (Michx.) Beauv.), sedges, rushes, iris, speckled alder, and spiraea (largely *Spiraea latifolia* Borkh. and some *Spiraea tomentosa* L.). Sphagnum is also found in certain places.

3. **Forsaith's Bog** (Fig. 4): This is a forest bog located about a mile from the State Forest Camp across the Sucker Brook Trail from the Beaver meadows. An abandoned tote-road, which



Fig. 4.—Abandoned tote road in Forsaith's Bog. See description of Station Number 3. Photo by Fivaz.

branches off the Sucker Brook road near camp, winds through this bog again to join with the Sucker Brook tote-road at the farther end of the burn. The plants indicate a secondary association following a balsam swamp forest and will ultimately be dominated by the latter. The arborescent forms are represented by balsam, red and black spruce (*Picea rubra* and *Picea mariana* (Mill.) BSP), a few larch (*Larix laricina* (DuRoi) Koch), hemlock (*Tsuga canadensis* (L.) Carr.), yellow birch (*Betula lutea* Michx. f.), and soft maple (*Acer saccharinum* L.). In addition there are willows (*Salix*. spp.) and some dense thickets of speckled alder. The bog type is represented by *Cassandra*, *Kalmia*, *Ledum*, *Vaccinium*, *Nemopanthus*, and the less conspicuous forms such as cranberry, aromatic winter green, snowberry, twin flower and the like. The terrene is generally covered with a deep matrix of sphagnum. Certain small areas in this bog are perhaps typically swamp-like or marsh-like. Collections were also made in other bogs, swamps and marshes which represent more advanced stages in the development of their plant associations.

4. **Lumbered Areas:** The recently lumbered areas in the vicinity of Proulx's Camp and other older logged areas in various stages of recovery were studied. These cut-over tracts were formerly a mixed coniferous and hardwood forest from which most of the soft wood had been removed.

5. **Burns** (Fig. 5): The burns on the Barber tract and near Wanakena offered the most attractive breeding places for Hemiptera. The former is a transitional association of fire cherry (*Prunus pennsylvanica* L. f.) and aspen (*Populus tremuloides*

Michx. and *Populus grandidentata* Michx.). The temporary character* of the cherry-aspen type is indicated by the presence of yellow birch, beech (*Fagus grandifolia* Ehrh.), hard and soft maple (*Acer saccharinum* L. and *A. saccharum* Marsh), and a small percentage of conifers (spruce, white pine (*Pinus Strobus* L), hemlock, and balsam) in the understory. The ground cover of seedlings, grasses and other herbaceous plants form a much greater variety than that of the logged, but unburned areas, and



Fig. 5.—Tote road near Sucker Brook leading through a large "burn" (Barber Tract) in cut-over areas and to lumber camp. See description of Station Number 5. Photo by Fivaz.

* The climax Adirondack forest consists of yellow birch, sugar maple and beech in a mixture with red spruce, white pine, balsam and hemlock.

virgin forest. There is also a much greater number of the individual plants of the various species.

6. **Crataegus Hill:** This is a small hill-top on the Barber tract about three-fourths of a mile from camp. *Crataegus* sp., ironwood (*Ostrya virginiana* (Mill) K. Koch), white ash (*Fraxinus americana* L.), red raspberry (*Rubus idaeus*, L. var., *aculeatissimus* (C. A. Mey.) Regel. & Tiling.), aster (*Aster macrophyllus* L.), boneset (*Eupatorium* sp.) and sedges and grasses are the principal plants.

7. **Big Floating Island** (Figs. 6 and 7): This station lies on the west side of Cranberry Lake near Joe Indian Island. Although stationary it is a typical floating island which has arisen through the massing of drift logs and other plant detritus resulting in a substratum which has enabled certain hardy plants to obtain a foot-hold. The vegetation represents a typical floating bog and consists of a heavy sphagnum matrix (8 to 10 inches deep of living sphagnum) surmounted by a dense thicket-like growth of *Cassandra* or leather leaf (*Chamaedaphne calyculata* (L.) Moench) and sweet gale (*Myrica Gale* L.) and a few clusters of speckled alder and an occasional larch.

8. **Grasse River Bog** (Fig. 8): This is a large bog located near Silver Lake and traversed by the Grasse River Railroad connecting Cranberry Village and Conifer. This region is intercepted by several brooks and is covered by a dense vegetation which, however, is restricted to relatively few plants. Here and there one finds almost a pure association of *Carex oligosperma* Michx. while clumps of *Cassandra*, speckled alder, labrador tea (*Ledum groenlandicum* Oeder), pale laurel (*Kalmia polifolia* Wang.), *Andromeda polifolia* L., low sweet blueberry (*Vaccinium pennsylvanicum* Lam., var. *angustifolium* (Ait.) Gray, with some withe-rod (*Viburnum cassinoides* L.) and chokeberry (*Pyrus melanocarpa* (Michx.), Willd., dot the surface.

9. **New York State Ranger School Tract:** This tract, located near Wanakena, N. Y., is controlled by the New York State College of Forestry. It includes an extensive burn, tote-roads, forests, bogs, swamps, and streams. Owing to the type of topography, over-run by high hills and depressions, it offers a wide range of habitats, plant associations and most excellent collecting. Conditions on this tract and other favorable areas in the vicinity of Wanakena are somewhat comparable to Barber tract on Cranberry Lake.

10. **Bean Pond** (Fig. 9): This is a small, open-water pond near the middle of an extreme type of Adirondack bog (Bray, l. c. pp. 125-128) with many of the bog-plants wholly removed and the more bog-tolerant species, chiefly dwarf black spruce, tamarack and leather leaf, growing in a deep and compact matrix of sphagnum. Small black spruce shrubs or apparent seedlings growing near the pond are practically as old as the larger ones or fairly large trees near the outer margins of the bog.

11. **Climax Forest Type*** (Fig. 10): This station was located on state land in a tract of virgin forest near the Oswegatchie River opposite from the New York State Ranger School. The trees consist of hardwoods dominated by conifers, especially white pine. Several specimens of the latter, about 125 feet tall and a D. B. H. of 42 to 49 inches, represent some of the most magnificent trees in the Adirondacks.

12. **The Plains** (Fig. 11): These areas are a series of openings near the Upper Oswegatchie River and are very typical of the so-called treeless plains of the Adirondacks. Bray quite fully



Fig. 6.—Big Floating Island, taken from a distance by Fivaz. See description of Station Number 7.

discusses these treeless areas in "The Development of Vegetation of New York State" (l. c., pp. 144-147) and states, "Borings show from two to three feet of compact, fine sand evidently offering poor aeration. Below, the deposit is darker, coarser and full of coarser grit. The water table is normally several feet below the surface, but the area has much the aspect of a wet lowlands, and during rainy seasons is in effect like an area of soaked soils. But, as in other sand areas, it is subject to extreme drouth."

As Bray has pointed out the plants of the "plains," as represented by complex associations of swamp, bog and typical members of barren vegetation, reflect the peculiar bioclimatic conditions of the region. These open heath barrens, margined by tamaracks which are slowly encroaching the open terrene, are gradually being broken up. They are also occasionally dotted with black spruce. The shrubs consist largely of mountain fly honeysuckle (*Lonicera caerulea* L.) blueberries (*Vaccinium canadense* Kalm., and *V. pennsylvanicum*, var. *angustifolium* and *V. vacillans* Kalm.),

* Typical Adirondack forest, see footnote, p. 9.

choke cherry (*Prunus virginiana* L.), *Pyrus arbutifolia* and *P. melanocarpa* (Michx.) Willd. Two wet-land grasses (*Avena Torreyi* Nash and *Oryzopsis asperifolia* Michx.), the abundance of creeping blackberry (*Rubus hispidus* L.) and two species of *Spiranthes* (growing among the wet-land grasses) tend to emphasize the hydrophytic aspect of the plains. Extreme areas are covered with reindeer moss which reaches its optimum development during the autumn months. Here and there golden rods, asters and spiraea are found among the shrubs and have a conspicuous place in the flora of late summer.



Fig. 7.—Big Floating Island; photo taken near the island by Osborn. See description of Station Number 7.

PALAEARCTIC HEMIPTERA OCCURRING IN THE CRANBERRY LAKE REGION

Horvath* very carefully studied and collated the genera and species of Hemiptera, known to occur in both Europe and America, especially those of the Palaearctic and Nearctic regions. He presents evidences to show that many of the species common to both faunas are of Palaearctic origin and that migration took place largely in an eastward direction by the way of Alaska. Many of the species known to occur in both regions have only been taken in eastern and northeastern localities of the United States and Eastern Canada. Although this is not in perfect accord with some of Horvath's theories and evidences, more collecting in the western regions of the United States and Canada will undoubtedly extend the range westward for many of the Palaearctic Hemiptera that have become permanently established in North America. Parshley†

* Horváth, G. Les relations entre les faunes hémiptérologiques de l'Europe et de l'Amérique du Nord, Ann. Hist. Nat. Mus. Nat. Hung., Budapest, 1908.

† Parshley, H. M. Fauna of New England. List of Hem.-Het. Occasional Papers Bos. Soc. Nat. Hist., VII, 1917.

has discussed the Palaearctic Hemiptera known to be established in New England and added a number of species of Heteroptera, which have been recently taken in New England, to Horvath's list, and Knight* has treated quite carefully the species of Miridae common to Nearctic and Palaearctic regions. Several species are apparently of rather recent introduction by human agencies and hence must be considered in a different class from those having naturally holarectic range.

Homoptera

<i>Philaenus leucophthalmus</i>	<i>Euscelis striolus</i>
<i>Evacanthus acuminatus</i>	<i>Cicadula variata</i>
<i>Acucephalus nervosus</i>	<i>Cicadula 6-notata</i>
<i>Acucephalus albifrons</i>	<i>Balclutha punctata</i>
<i>Deltocephalus abdominalis</i>	<i>Empoa tenerrima</i>
<i>Deltocephalus pascuellus</i>	<i>Empoa lethierryi</i>
† <i>Euscelis striatulus</i>	<i>Empoa rosae</i>
<i>Euscelis obsoleta</i>	<i>Dikraneura fieberi</i>
<i>Empoasca flavescens</i>	<i>Alebra albostriella</i>
<i>Empoasca smaragdula</i>	

Heteroptera

<i>Sciocoris microphthalmus</i>	<i>Stenodema trispinosum</i>
<i>Corizus hyalinus</i>	<i>Teratocoris paludum</i>
<i>Corizus crassicornis</i>	<i>Trigonitylus ruficornis</i>
<i>Aradus lugubris</i>	<i>Stenotus binotatus</i>
<i>Gerris rufoscutellatus</i>	<i>Poeciloscytus unifasciatus</i>
<i>Nysius ericae</i>	<i>Capsus ater</i>
<i>Galeatus peckhami</i>	<i>Lygus pabulinus</i>
<i>Reduvius personatus</i>	<i>Lygus apicalis</i>
<i>Nabis limbatus</i>	<i>Lygus pratensis</i>
<i>Nabis ferus</i>	<i>Monalocoris filicis</i>
<i>Cimex lectularius</i>	<i>Mecomma ambulans</i>
<i>Miris dolabratus</i>	<i>Saldula pallipes</i>
<i>Plagiognathus chrysanthemi</i>	<i>Callicorixa praeusta</i>

THE HEMIPTERA OF THE ADIRONDACKS

The first records of the Hemiptera of the Adirondack Mountains, published by MacGillivray and Houghton† in 1903, were collected during June, 1901, in the vicinity of Axton at an elevation of about 1,600 feet. This paper includes 53 species, 34 Heteroptera and 19 Homoptera respectively. A few years later Van

* Knight, H. H. Nearctic Records for species of Miridae known heretofore only from the Palaearctic Region (Heterop.) Can. Ent., Vol. LIII, Part 12, 1921, pp. 280-288. (Published in Jan. 1922).

† *Euscelis striatulus* and *E. obsoletus* of Horvath's list are separated by Van Duzee as *instabilis* and *relativus* respectively.

† MacGillivray, Alex. D. and Houghton, C. O. A list of the Insects in the Adirondack Mountains, N. Y.—III. Ent. News, Vol. 14, pp. 262-265, 1903.

Duzee* published a list of the species of Hemiptera known to occur in the Adirondacks. The latter, based on a few days' collecting at Lake Placid and Saranac Lake Junction in 1902 and the forms enumerated by MacGillivray and Houghton, contains 193 species of Hemiptera (92 Heteroptera and 101 Homoptera).

The present list enumerates 397 species and varieties of Hemiptera, 218 Heteroptera (one lygaeid not determined), and 179 Homoptera. All the species are from the vicinity of Cranberry Lake and 95 per cent or more of the forms occurring in this region have been taken on about 200 acres of the Barber tract. However, this portion of the tract is represented by a marked variety of ecological and biological conditions. It includes camp site, hills, marshes, bogs, beaver meadows, lumbered areas, forests, tote-roads, trails, open areas, dense growth of young trees, burned-over areas, coves of Cranberry Lake and the like. The following species, listed by Van Duzee, have not been taken in the vicinity of Cranberry Lake:

Homoptera

Lepyronia 4-angularis Say
Stictocephala lutea Walk.
Macropsis 3-maculata Fh.
Deltocephalus debilis (probably
abdominalis)
Deltocephalus compactus O. & B.
Aconura acuticauda Bak.
Chlorotettix viridis
Balclutha osborni Van D.
Trioxa 3-punctata Fh.

Heteroptera

Physatocheila plexa Say
Corythucha juglandis Fitch
 (probably *pallipes* Parsh.)
Xylocoris (Piezostethus) galac-
tinus Fieb.
Phytocoris conspersipes (brevi-
usculus) Reut.
Calocoris uhleri (tinctus) Van D
Dichrooscytus elegans Uhler
Halticus apterus (Linn.)
Strongylocoris (Stiphrosoma)
croceipes (Uhl.)
Pilophorus clavipes Uhler MS
Ceratocapsus (Melinna) mod-
estus Uhler.
Orthotylus chlorionis Say.
Orthotylus (Diommatus con-
grex Uhler *dorsalis* Prov.
Orthotylus (marginatus Uhl)
 (*Cyrtorrhinus*) *marginatus*
 Uhl.)
Plagiognathus obscurus Uhler

The above list includes 23 species of Hemiptera (14 Heteroptera and 9 Homoptera) not collected in the Cranberry Lake region. This gives a total of 409 species of Hemiptera for the Adirondack Mountains. However, the three papers taken together do not

Van Duzee, E. P. List of Hemiptera Taken in the Adirondack Mountains
 20 Rept. N. Y. St. Ent. pp. 547-556. 1904.

represent a complete list of Hemiptera for the Adirondacks. In fact the last day's collecting added four new species to the Cranberry Lake region. On the other hand, collecting in other parts of the Adirondacks where numerous trees and food plants occur, which are not found at all in the vicinity of Cranberry Lake, will undoubtedly add many new records.

Van Duzee* catalogues 381 species of Hemiptera (197 Heteroptera and 184 Homoptera) for Buffalo and vicinity. The Buffalo list covers several times as much area as the Cranberry Lake region covered by the authors.



Fig. 8.—Grasse River Bog near Silver Lake. See description of Station Number 8. Photo by Osborn.

LEAF HOPPERS OF NEW YORK STATE

Osborn† catalogues 184 species of leaf hoppers, Jassidae or Cicadellidae, for New York. The following species for Cranberry Lake and vicinity, not represented in the above list, are new records for the State: *Agallia oculata*, *Idiocerus amabilis*, *Idiocerus subnitens*, *Xestocephalus nigrifrons*, *Parabolocratus major*, *Deltocephalus ocellaris*, *D. misellus*, *D. nominatus*, *D. flavovirens*, *D. nigriventer*, *Euscelis deceptus*, *E. arctosaphyli*, *E. humidus*, *E. angustatus*, *E. elongatus*, *E. comma*, *Phlepsius maculellus*, *Thamnotettix cockereilli*, *T. morsei*, *T. belli*, var. *brunners*, *T. waldana* and *Cicadula pallida*. This gives a total of 206 species of Cicadellidae (Jassidae) for the state, of which 130 are recorded herein for the Cranberry Lake region.

* Van Duzee, E. P. A List of the Hemiptera of Buffalo and Vicinity. Bull. Buf. Soc. Nat. Hist., Vol 5, No. 4, pp. 167-205, 1907.

† Osborn, Herbert. Jassidae of New York State. 20 Rept. N. Y. St. Ent. for 1904, pp. 498-546.

NATURAL ENEMIES

Of the natural enemies of Hemiptera we can only offer incomplete records as time did not permit detailed studies of this phase of the associations. The mammals of the region, save perhaps the beavers, probably have little influence on the hemipterous fauna. The latter by the construction of dams have altered the conditions of the drainage channels and inundated rather extensive areas. As a result of the higher water level many of the plants have been smothered and replaced largely by more or less hydrophytic forms. With this transition of the vegetation there has, of course, been a change of the hemipterous content of the flooded areas.



Fig. 9.—Béal Pond on the New York State Ranger School Tract near Wanakena, N. Y. See description of Station Number 10. Photo by Osborn.

Birds are numerous and no doubt some of the species prey extensively on this group of insects, especially during certain parts of the year but we have not observed any specific instances of especial or noteworthy attacks on particular species. Reptiles are not great in numbers and are of little importance as checks upon Hemiptera. The Batrachians, especially frogs, are quite numerous and feed largely upon insects. No attempt has been made to study the contents of the stomachs of toads and frogs of the Cranberry Lake region, but the works of Kirkland,* Surface,† Drake,‡ Munz§ and others readily show the economic aspect of

* Kirkland, A. H. Habits, Food and Economic Value of the American Toads Bull. 46 of Hatch Exp. Station of the Mass. Agri. College, pp. 1-31, 1897; — Usefulness of the American Toad. Farmers' Bull. No. 196, U. S. D. A.; pp. 1-16, 1904.

† Surface, H. A. Economic Features of the Amphibians of Pennsylvania. Zool. Bull. Pa. Dept. Agr., 3, 67-152, 1913.

‡ Drake, Carl J. The Food of *Rana pipiens* Shreber. Ohio Naturalist, 14:257-269, 1914.

§ Munz, Philip A. A Study of the Food Habits of the Ithican Species of *Anura* During Transformation. Ponoma College Jl. of Ent. & Zool. 12:33-57, 1920.

these amphibians. The fishes of course consume many aquatic insects and forms that happen to fall into the water, but they have very little relation to the forest Hemiptera.

The predaceous Hemiptera play an important role in the control of plant-feeding Hemiptera and other phytophagous insects. Such ravenous forms as *Nabis limbatus*, *N. roseipennis*, *N. rufusculus*, *Podisus serieiventris*, *P. modestus*, *P. placidus*, *P. maculiventris*, *Anthocoris borealis*, *Tetraphleps osborni*, *Triphleps insidiosus*, *Deraeocoris* (*Camptobrochys*) *borealis* and the like are very conspicuous in the region studied. The aquatics are mostly predatory, but they sustain themselves upon aquatic insects and other aquatic animals and also upon insects that happen to fall in the water. Hymenopterous egg parasites were bred from the eggs of several of the Heteroptera and numerous Jassids were parasitized by dryinids. Tachinid eggs were observed on the backs of some of the Pentatomidae. Predaceous insects in other orders also destroy many Hemiptera.

Of the invertebrate groups associated with Hemiptera the spiders are of special interest and while the species are not numerous and individuals have not been observed as specially abundant they are probably the most important of the natural enemies.

Collections of these have been made incidentally while sweeping or beating for Hemiptera and specimens have been submitted to Dr. W. M. Barrows of the Ohio State University for identification. The following list should not be considered as representing the spider fauna of the region, but simply as indicating the most common species associated with the Hemiptera and from the known food habits* as constituting a natural check for this group as well as other associated insects.

Common Spiders of Cranberry Lake Region

Epeira insularis Hentz. Barber Point, no special habitat noted.

Epeira trifolium Hentz. Barber Point, collected in the Beaver Meadow, July 30, 1920.

Epeira trivittata Keys. Barber Point: marsh, July 5 and 28; willow, Aug. 5; tote road along Sucker Brook, July 28; virgin forest, July 28; Aug. 11; Plains, Aug. 3, 1920.

Epeira thaddeus Hentz. Virgin forest, Aug. 11, 1920.

Pellenes hoyi Peckham. Barber Point—no special habitat noted but according to Dr. Barrows this is a meadow species.

Tibellus duttoni Hentz. Barber Point, taken in the marsh and Beaver meadow, July 5, 28; tote road, July 28; on willows, July 28, "burn," July 28, 1920.

Tibellus oblongus (Walck). Barber Point, taken near the tote road leading to Forsaith's Bog, July 28, 1920.

Dendryphantes militaris (Hentz). Marsh and meadow tote road, July 28; burn July 27; on willows Aug. 5, 1920.

Dendryphantes capitatus (Hentz). Taken on willow, July 28, in dense virgin forest; Barber Point, July 29.

* Bilsing, S. W. Quantitative Studies in the Food of Spiders. Ohio Journal of Science, Vol. XX, 1920, p. 215-260.

- Dictyna frondea* Em. On willow, Barber Point, July 28.
Dictyna (bostonensis) Em. (?). Forsaith's Bog, Barber Point, July 28, 1920; not recorded hitherto except for eastern Mass.
Dictyna muriaria Em. Tote road near camp site, July 28, 1920.
Dictyna volucripes Em. In rotten wood at Barber Point, August, 1920.
Lophocarenum florens (Camb.) Tote road along Sucker Brook, July 28, 1920.
Tetragnatha laboriosa Hentz. On willows near tote road, Barber Point and virgin forest, July 28, 1920.
Tetragnatha grallator Hentz. Sweeping on yellow birch in "burn" at Barber Point, Aug. 2, 1920.
Linyphia marginata Koch. On willows near tote road leading to Forsaith's bog, July 28, 1920.
Theridium frondeum Hentz. Taken along tote road on willow in company with the above species, July 28, 1920.
Theridium murarium Em. On yellow birch at Barber Point, June 26, 1920.
Theridula sphaerula Hentz. In virgin forest, July 28, 1920.
Misumena vatia (Clerck). On *Salix*, July 28, at Barber Point.
Misumena sp. Young, taken at the Plains, Aug. 3, 1920; virgin forest, Aug. 11, 1920.
Helophora insignis (Blk.) Thor. Collected in the virgin forest, Aug. 11, 1920.
Mangora placida (Hentz). Sweeping grasses and weeds in tote road, July 28, 1920.
Agalena naevia Walck. Virgin forest, July 29, 1920. Dense young forest at Barber Point, July 29, 1920.
Xysticus limbatus Keys. Sweeping weeds near site, July 31, 1920.
Clubiona sp.? In virgin forest, July 28, 1920, at Barber Point, July 31, 1920.
Theridiosoma radiosa. (Em.) In dense young forest at Barber Point, July 29, 1920.
Chiracanthium viride Em. (?) In lumbered area, Barber Point, Aug. 20, 1920.
Pirata insularis Em. In Forsaith's Bog under sphagnum, Aug. 10, 1920.
Pardosa sp.? Virgin forest, Aug. 11, 1920.
Phidippus multiformis Em. Plains, Aug. 3, 1920.
Phidippus sp.? Barber Point, no special habitat recorded.
Sittacus striatus Em. (?) Barber Point, 1920.
Coriarchne versicolor Keys. Under bark near Proulx's lumber camp, Aug. 2, 1920.

Many of the spiders appear to have a very general distribution, especially such forms as *Epeira trivittata*, *Tibellus duttoni*, *Dendryphantes militaris* and *Tetragnatha laboriosa*. *Pirata insularis* seems to be confined to bogs, the only definite record being under sphagnum in a well-marked bog. *Agaleana naevia* was taken only in deep forest, but is known to occur in meadows. The distinctly forest species, as indicated by our records, are *Theridula sphaerula*, *Helophora insignis*, *Tetragnatha grallator*, *Coriarchne versicolor* and *Epeira thaddeus*.

The plains had a variety of species and *Phidippus multiformis* seems to be the only species limited in our collecting to this region. Most of the meadow or grassland species occurred in the woods or at least along the tote roads and trails, but *Epeira trifolium*, *Dictyna bostonensis*, *Pellenes hoyi*, and *Xysticus limbatus* are evidently more at home in meadow association.

METEOROLOGICAL RECORDS

The meteorological records of the United States Department of Agriculture Weather Bureau, taken by Mr. R. R. Streeter at the New York State Ranger School, Wanakena, New York, furnish the data for the table given below. The collecting, except a few forms secured during the last week in May and the first two weeks

in September, was confined entirely to the summer months of June, July and August. These months include (see table) the greatest period of insect activity and for many species practically the entire time for the development of the nymphal stages. The daily range of temperature is also quite marked. The nights are generally cool and, consequently, the insects are not very active during the latter part of the afternoon, early morning and night. As a result of the late spring and the unusually heavy rainfall during July (7.35 inches) the development of the immature stages was somewhat retarded and adults of many species were not taken until the latter part of the summer.

METEOROLOGICAL TABLE — 1920

	Temperature			Monthly Summary Mean Temperature			Precipitation		
	Maxi- mum	Mini- mum	Great- est daily range	Maxi- mum	Mini- mum	Mean	Rain- fall, inches	Snow- fall, inches	Greatest depth of snow on ground, inches
January.....	27 34°	31 —39°	20 57°	17.7°	—9.1°	4.3°	1.99	35.5	33.5
February.....	2 45°	28 —33°	1 54°	27.4°	1.4°	14.4°	3.24	24.5	52.0
March.....	25 66°	2 —27°	2 63°	41.7°	16.1°	28.9°	3.03	11.2	53.0
April.....	1 69°	19 42°	19 42°	47.2°	27.0°	37.1°	3.82	5.8	5.0
May.....	29 81°	25 46°	25 46°	68.1°	38.8°	53.4°	1.81	0	0
June.....	1-2 82°	26 37°	26 37°	73.1°	51.3°	62.2°	1.46	0	0
July.....	30 83°	30 32°	30 57°	71.9°	51.3°	61.6°	7.35	0	0
August.....	9 83°	4 33°	4 33°	75.7°	53.1°	64.4°	2.11	0	0
September....	26 81°	20 27°	21 35°	59.1°	54.4°	57.2°	5.11	0	0
October.....	15-16 75°	23 24°	24 44°	62.9°	50.2°	51.6°	1.85	0	0
November....	3 51°	2 45°	2 45°	36.6°	21.6°	29.1°	4.73	14.6	
December....	22 & 25 47°	9 39°	9 39°	36.1°	14.7°z	25.4°	4.45	35.5	12.0

THE HEMIPTEROUS FAUNA

Forest Associations

Primitive Forest: The Hemiptera of the deep woods association are limited in number of species, but consist of rather distinctive forms and some of them quite closely restricted to such

environments. An excellent example of pristine conditions is found on state land across the Oswegatchie River from the Ranger School. This tract includes untouched virgin forest of great age and dominated by some of the largest and most magnificent pines of the Adirondacks.



Fig. 10.—Virgin Forest on State Land near Wanakena, N. Y.
See description of Station Number 11. Photo by Drake.

The tree tops, of course, were far beyond our reach, but they may be expected to support many of the insects common to the same trees on the lower stratum of vegetation. The lower stratum consisting of seedlings of the principal forest trees, white pine, spruce, balsam, hemlock, yellow birch, hard and soft maple, beech, wintergreen, ferns, etc., furnished a habitat of quite special features, the most important being a deep bed of forest leaf-debris, humid atmosphere, and almost complete lack of direct sunshine. In this habitat the most frequent *Homoptera* were *Eupteryx flavo-scuta*, *E. nigra*, *E. vanduzeei*, *Thamnotettix waldanuss*, *Graphocephala coccinea* and *Gypona octo-lineata*, with an occasional *Oncopsis fitchi* and *O. variabilis*, the latter two possibly stragglers drifted down from the more favorable conditions of the tree tops. An aphid, *Hormaphis* sp., was rather common on yellow birch. The *Heteroptera* were represented particularly by *Miridae*—*Lygus pabulinus*, *Dicyphus agilis*, *D. vestitus*, *Macrolopus separatus*, *Diaphnidia capitata*, *D. pellucida*, *Phytocoris lasiomerus*, *Molanocoris filicis*, and *Camptobrochys borealis*—and a few other forms such as *Corythucha pallipes*, *Nabis rufusculus*, *N. roseipennis*, *Saldula interstualis* and *Micranthia humilis*. The Saldidae were taken along the bank of a small stream in the deep forest.

Bog Association: The Hemiptera of the bogs, as represented in Big Floating Island, Bean Pond, Forsaith's Bog, included such forms as *Euscelis humidus*, *E. instabilis*, *E. vaccinii*, *Phlepsius maculellus*, *Thamnotettix eburatus*, *Aphelonema histrionica*, *Laccocera vittipennis*, *Nabis limbatus*, *Ischnorrhynchus geminatus*, *Phytocoris lasiomerus*, *Psallus* n. sp., etc. *Europiella rubida*, *Plagiognathus fraternus*, *P. politus*, and *Camptobrochys laricis* were collected on larch. The aquatic forms, taken in Bean Pond and a small pond in Big Floating Island, are represented by *Gerris rufoscutellatus*, *G. buenoi*, *G. marginatus*, *Notonecta undulata*, *Buenoa margaritacea*, *Ranatra americana*, *Microvelia buenoi*, *Callicorixa praesuta* and *Artocorixa scabara*.

Swamp Association: The swamp meadow association included especially *Draeculacephala noveboracensis*, *D. manitobiana*, *Thamnotettix decipiens*, *T. ciliatus*, *T. placidus*, *Nabis limbatus*, *Phytocoris* sp., *Mecomma gilvipes*, *Stenodema trispinosum*, *S. vicinum*, *Trigonotylus ruficornis*, *Collaria meillearii*, *Homaemus aeneifrons* and several of the forms (aquatics and plant-feeders) listed in the bog association.

Plain Association: The Hemiptera of the Plains included especially *Philaronia bilineata*, *Philaenus lineatus*, *Pubilia concava*, *Deltoccephalus misellus*, *Laccocera vittipennis*, *Melanorhopala clavata*, *Thyanta custator*, *Coenus delius*, *Perillus exaptus* var. *d.* (fide Van Duzee), *Ortholomus longiceps*, *Nysius ericea*, *Crophius disconatus*, *Ilnacora malina* and *Mecomma gilvipes*. The latter was common along the trails in moist, shady places in larch thickets. The larch insects (see bog association) were very common in the pure stands of this tree.

Burn Associations: The older burned-over regions (see station number 5) included not only the Hemiptera common to the sur-



Fig. 11.—The Plains, located near the Upper Oswegatchie River. See description of Station Number 12. Photo by Prof. E. F. McCarthy.

rounding forests and cut-over areas but also many other species feeding upon the transitional, ericaceous and various other native and exotic plants peculiar to the burns, tote roads and small open areas along the trails and about the deserted lumber camps. These open areas and the camp site afforded breeding places for such campestral and caespiticolous species as *Deltocephalus inimicus*, *D. affinis*, *D. apicatus*, *D. pascuellus*, *Agallia sanguinolenta*, *Acucephalus albifrons*, *Bruchomorpha oculata*, *Liburnia campestris*, *Lygus pratensis obliteratus*, *Lygaeus kalmii angustomarginatus*, *Nabis rufusculus*, *N. roseipennis* and *Triphleps insidiosus*. Several examples of *Euscelis comma* were taken on the fine grasses in the trails. *Sciocoris microphthalmus* occurred on the red raspberry bushes and rank vegetation in the small open areas. The fire cherry trees were infested by *Typhlocyba obliqua*, *Psyllia carpinicola*, and especially *Psyllia 3-maculata*; the poplars (*Populus tremuloides* Michx. and *P. grandidentata*) by *Telamona reclinata*, *Idiocerus lachrymalis*, *Macropsis basalis*, *Empoasca smaragdula*, *E. viridis*, *Euschistus tristigmus* and *Corythucha elegans*.

The alders and willows growing along the streams and in moist situations supported a large association of Hemiptera. The species listed below for these plants, also yellow birch and white pine, are common to a number of habitats.

On willows (*Salix* spp.):

Idiocerus amabilis, *I. pallidus*, *I. alternatus*, *Macropsis viridis*, *M. basalis*, *Scaphoideus immistus*, *Thamnottetix cockerelli*, *Empoasca smaragdula*, *E. aureo-viridis*, *Trioga salicis*, *Pemphigus tessellata*, *Cymus discors*, *Corythucha elegans*, *C. mollicula*, *Lygus atritylus*, *L. hirticulus*, *Lygidea rubecula obscura*, *Platytlellus lasiomerus*, *Phytocoris salicis*, *Lopidea media*, *Diaphnidia pellucida*, *Ceratocapsus pumilus*, *Orthotylus dorsalis*, *Pilophorus amoenus*, *Deraeocoris borealis* and *Anthorcoris borealis*.

On yellow birch (*Betula lutea* Michx.):

Clastoptera obtusa, *Oncopsis sobrius*, *O. cognatus*, *O. fitchi*, *O. minor*, *Typhlocyba querci*, *Psyllia striata*, *P. carpinicola*, *Euschistus tristigmus*, *Banasa dimidiata*, *Meodorus lateralis*, *Ischnorhynchus geminatus*, *Corythucha pallipes*, *Eremocoris ferus*, *Lygus horticulus*, *L. fagi*, *Deraeocoris borealis*, *Hyaloides vitripennis*, *Pilophorus amoenus*, *Diaphnidia provancheri*, *D. capitata*, *Orthotylus translucens*, *Plagiognathus fuscus*, *Aradus robustus*, *A. quadrilineatus*, *Aneurys inconstans*, *Anthocoris borealis*, *Podisus sereiventris*, *P. modestus* and *P. maculiventris*.

On White Pine (*Pinus Strobus* L.):

Aphrophora parallela, *Empoasca coccinea*, *Elidiptera slossoni*, *Psyllia carpinicola*, *Phytocoris fulvovs*, *Plagilytus luridus*, *Deraeocoris pinicola*, *Pilophorus amoenus*, *Aradus niger* and *Tetrupleps osborni* n. sp.

In general the Hemiptera of the region may be considered as conspicuous members of every habitat studied. There are many aquatic species and some of the surface inhabiting species occur

in countless millions (*Rheumatobates rileyi*, *Trepobates pictus* and *Metrobates hesperius*) scattered over miles of the surface of Cranberry Lake and the Oswegatchie River. The shore dwelling species and the forms occurring in the swamps, bogs, marshes and meadows present a large array while the forest species occurring under bark, on the leaves and every possible part of the tree make up an aggregation that cannot possibly be overlooked by anyone giving the least attention to the complex association of the woodland. In general the greater number may be counted as plant feeders, but there are many predaceous forms that prey

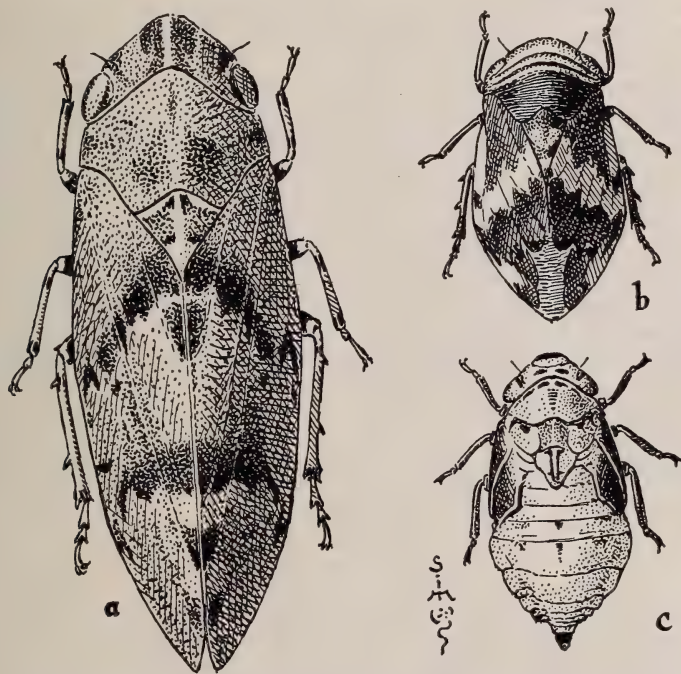


Fig. 12.—a, Pine Frog-hopper, *Aphrophora parallela* Say; b, (adult) and c, (nymph), *Clostoptera obtusa* Say.

upon other insects and many of course that sustain themselves on decaying vegetation in such manner as to have little influence on other organisms. However, no species can be considered as entirely independent of the other forms in the complex association of which they may be only a very minor part.

From an economic standpoint the majority of the Hemiptera must be counted injurious as by far the greater number are destructive to useful vegetation and especially to important forest trees. This may be considered especially true of the Homoptera, all the species so far as known being dependent upon growing plants for their food; none are aquatic in the true sense but several

species have become adapted to bog- or swamp-plants where they are subject to very humid conditions or at times must be able to undergo temporary immersion.

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HOMOPTERA IN THE VICINITY OF CRANBERRY LAKE

BY HERBERT OSBORN

Family *CICADIDAE*

This family is not represented in the Cranberry Lake region by any number of species, the only one which has been definitely recognized being *Tibicen canicularis*. The group is interesting on account of the extended life history of the 17 year *Cicada* and the root-feeding habits of the immature forms. They are of economic importance because of the punctures caused by the females in depositing eggs which are laid in the twigs or smaller branches of various forest trees. It would seem almost certain that *Tibicen rimosa* should be found in this region but no specimens have been observed. Also the species described as *T. noveboracensis* by Fitch would seem likely to occur as it was discovered from the eastern part of the state.

***Tibicen canicularis* (Harris).**

This, as stated above, is the only species definitely recognized. It was singing during August of the present year, but no specimens were captured.

Family CERCOPIDAE

The spittle insects or frog hoppers are quite noticeable on account of the masses of froth that surround the young and which adheres to stems of plants or twigs of trees in such quantity as to attract attention. Some of the species must be of considerable economic importance since they occur in such numbers as to cause a severe drain upon the plants affected. The most notable ones in this area are the meadow frog hopper and the forest frog hopper mentioned below.

Aphrophora parallela (Say) (Fig. 12, a).

Cranberry Lake (Barber Pt.), July 8, 1917; Aug. 1-8, 1917; Aug. 4, 1918.

Wanakena, Aug. 1-7, 1917. The species is apparently limited to coniferous trees as it has apparently never been recorded outside of the coniferous area and is the most common species on the conifers; its nymphal stages and the associated froth masses appear during June and early July. The adults are not uncommon in July and egg-deposition occurs during July or August.

This species is capable of considerable injury to the coniferous forests being very generally distributed and abundant and the punctures on the twigs resulting in weakening; wilting, or occasionally killing of terminal twigs; the evidence of injury, unless the froth masses are observed, are apparent only some time after the attack has been made. It may commonly be credited to other sources of injury as the real culprits may have entirely disappeared when the injury becomes evident. Adults probably feed to quite an extent on the twigs or smaller branches but with less drain upon the plant than during the nymphal stage. It has been bred from spruce and pine and may occur on other conifers.

Aphrophora 4-notata (Say).

This occurs on quite a large variety of plants and in some locations is very common. It is apparently most frequent in the low ground locations along streams or lake margins, although one captured on the plains, which was in a border of a thicket, might indicate more open habitat. Cranberry Lake, July 11-14-20, 1917, July 28-30. Aug. 11, 1920. Wanakena, Aug. 1-7, 1917. This species also occurs on a variety of plants and has been taken in a number of different plants, especially in the vicinity of Barber Point.

Philaronia bilineata (Say).

This species is common on the western plains and during the present season was found only on the "plains" where it occurred in open meadows upon the plains grass. In such location it is quite abundant, but can hardly be counted an economic species in this region. Cranberry Lake, July 24, 1917. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

Philaenus leucophthalmus (Linnaeus) (Fig. 13).

The meadow frog-hopper is one of the most abundant of the spittle-insects and throughout the entire New England region occasions no little injury to plants, especially clover and other legumes, but does not attack the grasses. It has no restricted habitat except that it does not occur in the deeper woods and its froth masses are most commonly observed on the small shrubs or annuals. The froth masses of this species are not distinguishable from those of *P. lineatus*, but there seems to be a distinct choice of food plant; it occurs on a great variety of plants but, so far as observed, not on grasses. The occurrences of special interest



Fig. 13.—Froth masses of *Philaenus leucophthalmus* Linn. Photo by Fivaz.

here are on fire cherry, and raspberry, but they abound on many plants, especially those of the family *compositae*.

The larvae of this species are to be separated from those of *P. lineatus* by the relatively shorter, blunter head. The froth masses including nymphs appear for this locality at the same time as those of *P. lineatus*, late June and early July, the adults beginning to appear by July 10 (1920) and becoming abundant a little later.. The species occurs in many different varieties both in Europe and America and most of these varieties have been observed in the Cranberry Lake region. Cranberry Lake, July 21, 1917, Aug. and July 2, 1920; Camp, early July, 1920; Wanakena, Aug. 1-7, 1917; Grasse River, July 22, 1920; Plains, Aug. 3, 1920.

Philaenus lineatus (Linnaeus).

The grass frog-hopper is very similar to the preceding but seems to restrict itself to grasses and consequently it is only found in open land, possibly more frequently in the more moist habitats. Observations in Maine showed this species to be closely restricted to various species of grasses and while we have not bred out adults for this region the immature forms examined bear out the conclusion that the species is essentially a grass-feeder here. The froth masses have been very plentiful on timothy (introduced) on the camp grounds and on native grasses of the vicinity. Its distribution is apparently determined by that of host plants, but wherever such plants are available along trails of "tote roads" they may be found penetrating well into the woodlands and on hill sides or ridges of all parts of the region. Wherever grasses are of value the species may be counted of distinct economic importance. Cranberry Lake, July 18, 1917; Aug. 1-7, 1917; July 3-5, 1920; Wanakena, Aug. 1-7, 1917, and July 29, 1920; Grasse River, July 22, 1920; Plains, Aug. 3, 1920.

Clastoptera obtusa Say (Fig. 12, b and c).

This is a very common species on birch, alder and other trees and shrubs and may be considered of distinct economic importance in the forest as on some occasions a large number will be found on a single branch and the sap drawn from the plant for the formation of the froth masses must mean a very considerable loss to the plant. While apparently protected very well by the froth mass, in one instance a species of mirid, *Deraeocoris* (*Campobrochys*) *borealis*, was found with its beak inserted in the nymph within the froth mass. This species has been particularly conspicuous during the season, its froth masses occurring in abundance on several trees and shrubs, but in especial abundance on the yellow birch, often several froth masses with at least one nymph in each mass hanging from a single twig. The froth masses on birch frequently show a large quantity of liquid with very few bubbles so that they appear watery or quite transparent and the nymph is very easily seen within the mass of fluid. Midges have been found adhering to the fluid mass, their legs entangled in the glairy substance much as a fly is entrapped in tanglefoot. Froth masses on birch, noted about July 10 and enclosed in twig cage, produced adult the 23d of July, 1920.

Yellow birch is apparently the most infested of any of the trees of the vicinity. The general distribution is emphasized by their occurrence on birch in dense forest and it is quite probable they may be occasionally abundant in the tree tops that are out of reach of observation and constitute a distinct drain on the growth of the trees. Cranberry Lake, July 30-31, 1917; July 2-31, 1920. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

Clastoptera proteus Fitch.

Also a very common species but apparently restricted more to the lower or very moist locations and occurring on heath plants, especially blue berries and cranberries. Cranberry Lake, July 28, 1917; Aug. 1, 1917; (Nymphs) July 3-6, 1920; (Adult) Aug. 10-11, 1920. Wanakena, Aug. 1-7, 1917.

Family MEMBRACIDAE**Ceresa diceros** (Say).

This species, which is abundant in some locations, has not been observed commonly and probably is restricted to some food plant which is not abundant here. Cranberry Lake, Aug. 1 and Sept. 15, 1917. Wanakena, Aug. 1-7, 1917.

Ceresa bubalus (Fabricius).

The Buffalo tree-hopper, which is such a very abundant species throughout the country, occurs here only sparingly and is evidently not a forest species but adapted to open areas or particularly to annuals or shrubs. Where abundant, the eggs being deposited in branches or twigs of trees have occasioned very considerable injury, but owing to its scarcity it might be considered of no economic importance for this region and probably for the Adirondacks generally. Cranberry Lake and Barber Point, Aug. 9, 1920. Wanakena (Ranger School), Aug. 12, 1920.

Ceresa basalis Walker (Fig. 14, *a* and *b*).

This is the most common species of the genus for the Adirondack region and is found in low ground on the grasses and annual plants. It is sufficiently abundant to be counted distinctly injurious for the plants on which it occurs. The species is northern in its distribution and, except for high land, shades out into about the latitude of the Adirondacks. Cranberry Lake, July 28, Aug. 1, 1917; Sept. 15, 1917; July 30, 1920; Aug. 10, 1920. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

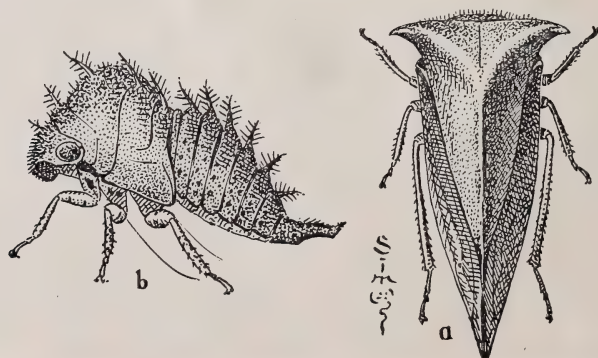


Fig. 14.— *Ceresa basalis* Walk: *a*, adult; *b*, nymph.

Carynota stupida (Walker) (Plate III).

This is the most abundant species observed affecting the forest trees in the region and more detail is given in the section devoted to its life history. Cranberry Lake, July 28, 1918; nymphs abundant on birch, July 2-15, still present July 29, 1920; adults, July 13, Aug. 11, 1920. Wanakena, Aug. 1-7, 1917.



Fig. 15,—Scars from egg deposition of *Telamona* on aspen. About natural size. Photo by Fivaz.

Carynota marmorata (Say).

Cranberry Lake, July 26, 1917.

Telamona declivata Van Duzee (Figs. 15 and 16).

This species has been noted as quite common on willows and might be considered an economic species if the willows were of greater commercial value. Cranberry Lake, July 11; Aug. 4, 1917.

Telamona barbata Van Duzee (Fig. 17, *a*, *b* and *c*).

The specimens referred to here agree closely with description by Van Duzee, except that the marking are more profuse.

Telamona reclivata Fitch.

Wanakena, Aug. 1-7, 1917. A single nymph which may very probably belong to this species was taken from poplar.

***Telamona coryli* Fitch.**

Wanakena, July 15 and Aug. 12, 1920; beaten from *Corylus*.

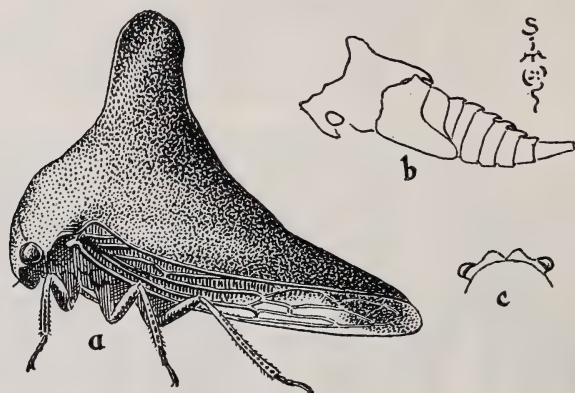


Fig. 16.—*Telamona declivata* Fitch: a, adult (side view); b, Outline of nymphal skin; c, Outline of head from above.

***Publilia concava* (Say).**

A common, often abundant species of wide range but not taken here except at the Plains, Aug. 3, 1920.

***Campylenchia latipes* (Say).**

Cranberry Lake, Sept. 15, 1917, July and Aug., 1920. Plains, Aug. 3, 1920. Very common, especially where leguminous plants furnish appropriate food.

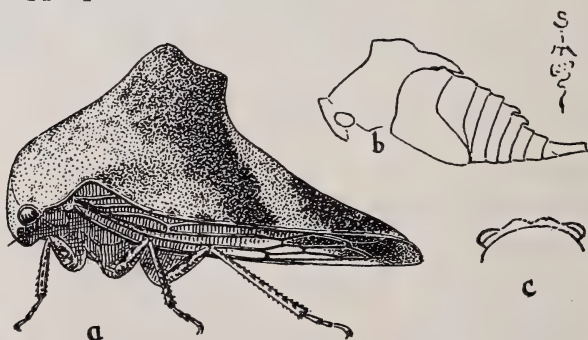


Fig. 17.—*Telamona barbata* Van D.: a, adult (side view); b, Outline of nymph; c, side view; d, outline of head from above.

***Enchenopa binotata* (Say).**

Plains, Aug. 3, 1920.

***Microcentrus caryae* (Fitch).**

Cranberry Lake, July 11, 1917.

Family CICADELLIDAE***Agallia novella* (Say).**

Taken especially in undergrowth of trails and along tote roads and probably feeds on quite a varied list of food plants. State Forest Camp, Barber Point, July 3, 1920. Adults, collected at the Plains, Aug. 3, 1920.

***Agallia 4-punctata* Provancher.**

Much less common than the preceding species and probably somewhat limited as to food plants, occurring in woods near the trails. It has been recorded as common on cultivated crops but may be considered of practically no economic importance for this region. State Forest Camp, Barber Point (adults), July 3, 1920. Wanakena, Aug. 12, 1920. Plains, Aug. 3, 1920.

***Agallia oculata* Van Duzee.**

A single specimen taken here appears to be distinctly identical with the form described as *oculata*, the common range of the species being south and into the tropical parts of the continent.

***Agallia sanguinolenta* (Provancher).**

A common species where clover or other legumes occur. In other localities this species is of very distinct economic importance as it attacks cultivated crops, but in the Cranberry Lake region it is only found in the trails or tote roads where introduced grasses or clover furnish it a good basis. Most of the individuals captured were rather small in size compared with the forms taken in other localities. Cranberry Lake in July and Aug., 1920. Plains, Aug. 3, 1920. Wanakena, Aug. 12, 1920.

***Idiocerus amabilis* Ball (Plate I, Fig. c.)**

Quite common on willows, especially along Sucker Brook and in the East Flow on willows which overhang the water. Newly transformed adults are a brilliant yellow-green with golden luster. Head and pronotum brown with lighter marking; vertex solid green at sides, brown on central part except narrow whitish median stripe. The face for the upper part is like the vertex below the ocelli green. The antennae light green at base and the bristles dark; underneath, except for the mesothorax, brilliant green. The tarsi whitish with the spurs and claws black. Cranberry Lake, July 18-24, 1920. Wanakena, Ranger School, July 15 and Aug. 12, 1920.

***Idiocerus formosus* Ball.**

Taken along stream and probably feeds on willows. Cranberry Lake, Aug. 3, 1920.

***Idiocerus pallidus* Fitch.**

Common on various species of willow and one of the most abundant forms upon this plant. It is apparently not capable of

living on other food plants so that its economic importance is restricted to the value of the willow. State Forest Camp, July 2. Grasse River, July 22, 1920. Wanakena, Aug. 12, 1920.

Idiocerus suturalis Fitch (Plate I, Figs. *a* and *b*).

Forest Camp, July 2, 1920. Grasse River, July 22, 1920. Wanakena, July 29 and Aug. 12, 1920.

Idiocerus alternatus Fitch.

Common on poplars and willows and one of the more abundant forms of the genus. This occurs over wide territory and in a number of more or less distinct varieties. State Forest Camp, July 5, 1920. Grasse River, July 22, 1920.

Idiocerus subnitens Sanders and Delong.

Numerous specimens, taken at Barber Point on willow, 1917, 1919 and 1920. A few specimens were also collected on poplar, but *Salix* seems to be the preferred food plant. The insect was described from Wisconsin.

Idiocerus lachrymalis Fitch.

The nymphs of this species were quite abundant on aspen early in July. The adults appear later in the season so that the species may be counted fairly common and as it is most abundant upon the aspen its injury may be considered as limited to the latter tree. The egg punctures in the twigs and smaller branches occasion large swellings and distortions and no doubt weaken the limbs so that they are easily broken. State Forest Camp, July 2, 1920. Grasse River, July 22, 1920.

Idiocerus provancheri Van Duzee.

While this species has been taken on plants away from bogs in other regions, all of our specimens here have been from bog plants and this seems to be its restricted habitat, the special plants on which it occurs being *Viburnum* or *Cassandra*. This species is not abundant but a number of specimens have been taken at different points. State Forest Camp, July 5, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

Macropsis viridis (Fitch).

This is perhaps the most abundant of the genus and is found on almost every willow, that is, during the time they are in season, July and August. State Forest Camp, July, 1920. Grasse River, July 22, 1920.

Macropsis sp.

Cranberry Lake, 1920.

Macropsis basalis (Van Duzee) (Plate I, Figs. *e*, *f* and *g*).

This occurs in two distinct varieties (var. *basalis*), one in which the deep marking of the wings is limited to the base and the other

(var. *fumipennis*) there are either two distinct bars or the entire wing is dark smoky or brown. The two forms occur on the same trees (willows and aspen), and, in so far as could be noted, the varied specimens develop from identical larvae. Upon further rearing of the individual it would be desirable to confirm this point. They are so plentiful on aspen that they may be counted injurious. State Forest Camp, July 3, 1920. Grasse River, July 22, 1920. Wanakena, Aug. 12, 1920.

Macropsis canadensis (Van Duzee) (Plate I, Fig. *d*).

Taken on the willow, especially in the lower ground along region of lake or brook, but less abundant than some of the other species. Cranberry Lake and Barber Point, July 13, 1920.

Oncopsis variabilis (Fitch) (Plate I, Figs. *i* and *j*).

This is an extremely variable species and occurs in several different forms, the most abundant one being bright yellow with black strips along the claval suture. Its common food plant appears to be yellow birch, also white birch, and it has been taken in dense woods as well as along the margins of thickets of the forest. State Forest Camp, Barbers Point, July, 1920. Grasse River, July 22, 1920. Wanakena, July 29, 1920. Plains, Aug. 3, 1920.

Oncopsis sobrius (Walker).

This species is evidently common on the yellow birch and while this may not be its only food plant, it would seem to be the common one. But the species is less abundant than in Maine and does not rank with one or two of the other species of the genus as a forest pest if we may judge by its occurrence during the present season. Cranberry Lake, June 30, 1919.

Oncopsis cognatus (Van Duzee) (Plate I, Fig. *h*).

Specimens placed here were collected at Wanakena, Aug. 1-7, 1917. A number of other specimens collected at Barber Point from yellow birch, July 13-24, 1920, seem to agree structurally with this form but are quite uniformly cinnamon brown in color. They may constitute a variety or possibly a distinct species but it is desirable to have more biological data before multiplying species in this extremely variable genus.

Oncopsis fitchi Van Duzee (Plate I, Figs. *k* and *l*).

Very abundant on a variety of plant-hosts, especially birch, and apparently the most important species of the genus. Its attacks result in a drain upon the plants and egg punctures of this species are noted so abundantly on some trees as to become injurious. State Forest Camp, July 2, 1920.

Oncopsis pruni (Provancher).

Very few specimens have been referred to this species and these appear closely related to *fitchi*. Barber Point, July 17, 1920.

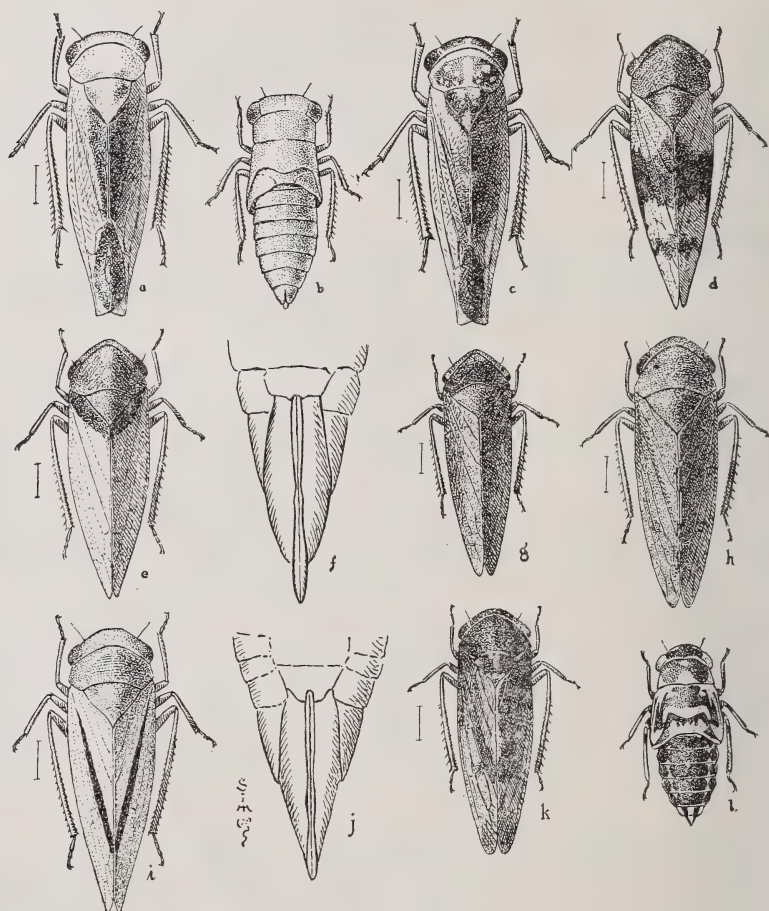


Plate I.

a, *Idiocerus suturalis* Fitch; b, *Idiocerus suturalis* — nymph; c, *Idiocerus amabilis* Ball; d, *Macropsis canadensis* Van Duzee; e, *Macropsis basalis* — female; f, *M. basalis* — female genitalia; g, *M. basalis* — female; h, *Onocopsis cognatus* Van Duzee — female; i, *Onocopsis variabilis* Fitch — female; j, *O. variabilis* — female genitalia; k, *Onocopsis fitchi* Van Duzee; l, *O. fitchi* — nymph last instar.

Oncopsis minor (Fitch).

Apparently one of the common forms on yellow birch but not easily separated from *fitchi*. Barber Point, July 9, 10, 13 and Aug. 2, 1920.

Oncopsis nigrinasi (Fitch).

State Forest Camp, Barber Point, July 5, 1920.

Oncometopia lateralis (Fabricius).

This species has a very wide range, occurring from Canada to the southern U. S. and infesting a great variety of plants. It lives in a great variety of habitats. At Cranberry Lake it was taken in the Plains region of the low ground along streams and on the hill tops, but occurred in greatest abundance at the "French Camp," Wanakena (Aug. 12, nymphs and adults were taken in large numbers). These were secured by sweeping grass and apparently the species was feeding in this location although possibly they may have developed on herbaceous plants in the immediate vicinity. Cranberry Lake, Sept. 15, 16, 1917; (nymphs and adults) July 28, 1920. Nymph-Plains, Aug. 3, 1920, and one adult Aug. 12, 1920. Grasse River, July 22, 1920. Wanakena, Aug. 1-7, 1917.

Cicadella gothica (Signoret).

Abundant in woods and along road-sides or trails on various plants. Doubtless a common feeder on many shrubs and trees in the forest association. Young nymphs abundant Aug. 6, Barber Point. Cranberry Lake, July 3, Aug. 5 and Sept. 15, 1917; July 2-14, 1920; (adults Aug. 1, 1917; (nymphs) July 15-31, 1920. Wanakena, Aug. 12, 1920. Plains, Aug. 3, 1920 (nymphs and adult).

Helochara communis Fitch

Usually very abundant in low places on *Juncus* which is probably its most common food-plant, although it may occur in other vegetation, especially in the adult stage. Cranberry Lake, Aug. 10, 1917. Wanakena, Aug. 3, 1920.

Graphocephala coccinea (Forst.).

Abundant in low vegetation in woods, especially in moist fern covered areas. Probably a general feeder on the plants of this association. Cranberry Lake, Aug. 5, 1917 (adult). State Forest Camp, July 2-10 (nymphs), July 24 (adults), 1920. Buck Island, Aug. 9, 1920. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Wanakena, July 29, 1920 (nymphs and adults). Plains, Aug. 3, 1920.

Draeculacephala mollipes (Say).

This very common and abundant species, which ranges all the way from Canada to Central America occurs on a variety of grasses but usually in dry or moderately moist locations. In the forest it is found along trails, tote-roads and streams. Cranberry Lake, July 2, 3, 6, 23 and 26, 1917; July 2, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920. Wanakena, Aug. 12, 1920.

Draeculacephala manitobiana Ball.

This species has been taken along with the preceding in swamp meadows but it was the most abundant in the large swamp meadow of the Grasse River where it occurred on *Carex oligosperma* which (it would seem) must be the food plant for the young as well as

the adults. Barber Point. Grasse River, July 22, 1920. Wanakena, July 15; Aug. 12, 1920. Plains, Aug. 3, 1920.

***Draeculacephala noveboracensis* (Fitch).**

Abundant in the swamp meadows both at Barber Point and Grasse River. Perhaps the most common of the species occurring in this habitat and feeding upon some of the coarse grasses as *Calamagrostis*. Such plants must furnish their food supply as the nymphs are taken in the same locations and in large numbers, both nymphs and adults being found during the latter part of July and early August. Cranberry Lake, July 26, 1917; July 14, 1920 (nymphs and adults). Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

***Evacanthus acuminatus* (Fabricius).**

Taken only in the forest and generally associated with ferns but this is not its probable host plant. Cranberry Lake, July 23, 1917. Wanakena, Aug. 1-7, 1917; July 29, 1920. Adults, Plains, Aug. 3, 1920.

***Gypona octo-lineata* (Say) (Fig. 18*a, b, c, d* and *e*).**

This species has very extensive distribution over the U. S. and Canada and occurs in a number of varieties which have been designated under different names. The ones most common in this region are the typical variety with distinctly reticulate wings, while the less reticulate forms are found more commonly in bogs or distinctly moist locations. A nymph taken on spruce with

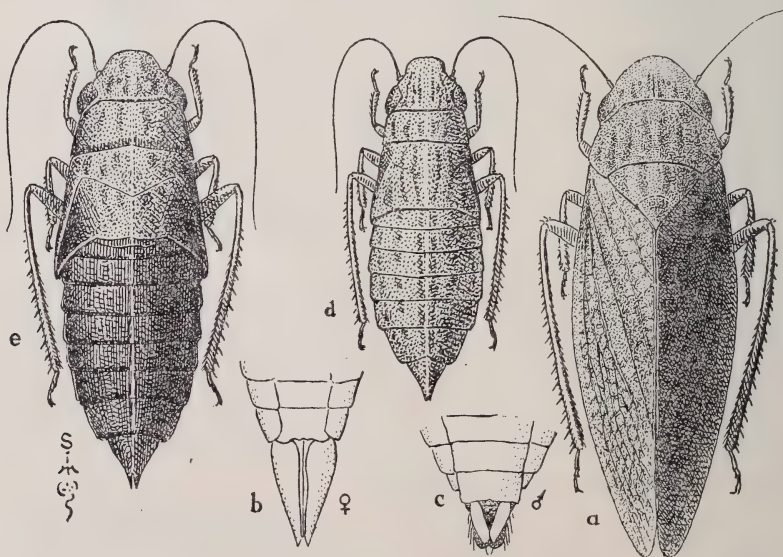


Fig. 18.—*Gypona 8-lineata* Say: *a*, adult; *b*, female; *c*, male genitalia; *d* and *e*, nymphs of later instars, probably 4th and 5th.

practically no other plants adjacent showed a striking resemblance to the color of the spruce leaves and also distinct marking of abdomen, having two very distinct black stripes so arranged as to parallel the lines of the leaves upon which the insect would attach itself. The species in general evidently has a very wide range of food plants. Cranberry Lake, Aug. 1; July 24, 1917. Buck Island, Aug. 9, 1920 (adult and nymph). Wanakena, Aug. 1-7, 1917; July 29, 1920; Aug. 12, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

***Acucephalus nervosus* (Schrank).**

An abundant species on meadow grasses but not common in the stations collected. In Maine, especially in the cultivated fields, it is so abundant as to be recognized as of distinct economic importance. Cranberry Lake, Aug. 1, 6 and 11, 1917. Silver Brook, Grasse River, July 22, 1920. Wanakena, Aug. 12, 1920.

***Acucephalus albifrons* (Linnaeus).**

Taken at Barber Point close to the Camp where timothy and other grasses furnish an abundant support. This species has been found to feed on the crown of timothy and it occurs commonly so far below the surface that it is seldom taken in ordinary sweeping. In cultivated fields it assumes very considerable importance. Cranberry Lake, Aug. 1, 1917; Aug. 6 and 9, 1920. Wanakena (French Camp), Aug. 12, 1920.

***Xestocephalus pulicarius* Van Duzee.**

Wanakena (Bean Pond), Aug. 12, 1920.

***Xestocephalus nigrifrons* Osborn.**

Wanakena (French Camp), Aug. 12, 1920.

***Parabolocratus viridis* (Uhler).**

Wanakena, Aug. 12, 1920.

***Parabolocratus major* Osborn.**

This species has been taken elsewhere upon *Calamagrostis canadensis* and as this grass occurs in the swamp meadows where it has generally been taken, it is probable that this has furnished its food in this locality. None have been taken except in the marsh meadows or similar locations. Cranberry Lake and Barber Point, July 3, 1919 (adult); June 9, 1920 (nymph). Wanakena, Aug. 1-7, 1917; July 15, 1920. Silver Brook, July 22, 1920 (adult).

***Mesamia vitellina* (Fitch).**

This species has been one of the most frequent captures of the less common forms and has been taken in sweeping maple and other undergrowth so that it has seemed probable that maple may be at least one of its principal foodplants. Nymphs associated

with these adults, and which resemble very closely those of *Thamnotettix kennicotti*, were thought to be the young of this species; and it is possible that the nymphs of the two forms are quite similar. One such nymph was kept in a cage and fed on maple leaves for about four weeks but it did not mature. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Ranger School, July 15, 1920 (adult). Grasse River, July 22, 1920 (adult). Plains, Aug. 3, 1920.

Scaphoideus auronitens Provancher.

Nymphs, Plains, Aug. 3, 1920.

Scaphoideus scalaris Van Duzee.

This is a very common species west but occurs quite rarely in this region, only one record having been made. Cranberry Lake, Aug. 1, 1917.

Scaphoideus lobatus Van Duzee.

Usually taken on grasses in open wood. Cranberry Lake, Aug. 1, 1917.

Scaphoideus productus Osborn.

This appears to be about the most common species of the genus for this region, much more plentiful, if we can judge by our collection, than the following species which is the most abundant one for the country at large. Cranberry Lake and Barber Point, July 25, 28, 1917; Sept. 15, 1919. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920; (nymphs) July 15 and Aug. 3, 1920. Bear Mountain, Aug. 15, 1920.

Scaphoideus immistus (Say).

Taken very rarely, although it is by far the most common and generally distributed species of the genus in the U. S. It is taken on willows and grape and these are probably to be included among its host plants. Cranberry Lake, Aug. 5 and 10, 1917.

Platymetopius acutus (Say).

A common and very widely distributed species equally at home in open fields or forest, on low land or hill top, evidently having a great latitude of food plants. It is perhaps the most universally distributed of any species of leaf-hopper taken in this region, appearing in almost every sweeping for almost every habitat studied. Cranberry Lake, Barber Point, July and Aug., 1920. Wanakena, Aug. 12, 1920.

Platymetopius acutus (Say) var. **cinnamomeus** Osborn.

This variety appears to grade into the typical form, but nymphs which have been reared to this form seem to have a fairly distinct marking and, as such nymphs are most abundant in boggy locations and seldom taken in higher altitudes, it would appear that

there has been a fairly distinct separation of the form from the common stock. Cranberry Lake and Barber Point, July and Aug., 1920. Wanakena, Aug. 12, 1920.

Platymetopius cuprescens Osborn.

Found in open grass covered places, usually the drier spots. Wanakena (Plains), Aug. 3, 1920.

Platymetopius magdalensis Provancher.

Found in boggy places, especially in the blueberry association. Cranberry Lake, Aug. 10, 11, 1920. Wanakena, Aug. 12, 1920.

Deltocephalus productus (Walker).

The food plant of this species must be the grass occurring on the high ridges, as the species has been taken only in such locations and along the plains where similar habitat occurs. It is very rare, few specimens having been taken, but very likely if its particular food plant were known a larger number could be secured. Cranberry Lake and Barber Point, Aug. 5, 1920. Plains, Aug. 3, 1920. (May be *delector* S. & D.)

Deltocephalus delector Sanders and DeLong.

Taken in company with *D. productus* on grasses growing on rather high ridges. Barber Point, Aug. 5, 1920. Plains, Aug. 3, 1920.

Deltocephalus configuratus Uhler.

An abundant species in grasses and widely distributed through the northern U. S. and Canada. Cranberry Lake and Barber Point, Aug. 1, 1917. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Plains, Aug. 3, 1920. Ranger School, July 15, 1920.

Deltocephalus acus Sanders and DeLong.

Barber Point, Aug. 9, 1920. Plains, Aug. 3, 1920.

Deltocephalus ocellaris (Fallen).

This form which appears to be related to *Deltocephalus sayi* has been taken on grasses, on "tote roads" and on the plains. It differs from *D. sayi* in being much broader, the head shorter and wider and especially by the ivory-yellow or whitish markings on the clavus. Cranberry Lake, Barber Point, July 13, 1920. Wanakena and Plains, Aug. 3, 1920.

Deltocephalus sayi (Fitch).

This species is common in both open grass land and shaded grassy patches of forest. It is parasitized by Dryinids which doubtless serve as a considerable check to the multiplication of the species. Cranberry Lake, July 6 and Aug. 5, 1919; July 2-15, 1920. Wanakena, July 15; Aug. 12, 1920; Aug. 1-7, 1917. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

***Deltocephalus misellus* Ball.**

This species has been taken in large numbers in a number of different localities and has apparently a rather wide range of food plants, although in Maine it was observed most abundantly upon the Canadian blue grass. It is subject to considerable variation in color, some of the forms being distinctly blackish while others are quite pallid. Cranberry Lake, July 2-30, 1920. Plains, Aug. 3, 1920.

***Deltocephalus apicatus* Osborn.**

This species appears restricted here and elsewhere through the state by the host plant, *Panicum huachuchae*. Cranberry Lake, Barber Point, Aug. 9, 1920. Wanakena, Aug. 12, 1920.

***Deltocephalus inimicus* (Say).**

This species is one of the most injurious of the leaf-hoppers. Over cultivated meadows and pastures and throughout the dairy region it has a very considerable economic importance. While occurring on a large variety of grasses in the Cranberry Lake region, there is so little of the area devoted to agriculture that it may be considered of small importance. It is abundant in the grasses of the campus at the Summer Camp and Ranger School and in the forest around Wanakena, also in the Grasse River section. It is quite extensively parasitized, both nymphs and adults being noticed with parasites attached. Cranberry Lake, Barber Point, July 1, 1920. Wanakena, July 15, Aug. 12, 1920. Ranger School, July 15, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

***Deltocephalus abdominalis* (Fabricius).**

A common grassland species. Cranberry Lake, July 26, 1917. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Ranger School, July 15, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

***Deltocephalus pascuellus* (Fallen).**

Very common in grasslands and sufficiently abundant to be of distinct economic importance. Cranberry Lake, July 20, 1917. Wanakena, July 15 and 29, 1920; Aug. 12, 1920. Ranger School, July 15, 1920.

***Deltocephalus melsheimerii* (Fitch).**

This species appears to be restricted for this area to a species of *Bromus* and occurred abundantly in the Plains, Aug. 3, 1920, and less commonly on Buck Island, Aug. 9, 1920, and the "French Camp" near Wanakena, Aug. 12, 1920.

***Deltocephalus striatus* (L.) (= *affinis* G. & B.).**

This species is very much less common than in the cultivated parts of the country where it is an abundant species in pastures and meadows. Cranberry Lake, July 5, 1920.

Deltocephalus nominatus Sanders and DeLong.

Cranberry Lake, July, 1920. Plains, Aug. 3, 1920. Wanakena, Aug. 12, 1920.

Deltocephalus sylvestris Osborn and Ball.

This has occurred as one of the most frequent species and in a variety of altitudes, but particularly in shaded or woodland grasses where it sometimes appears in very great abundance. It is quite extensively parasitized by dryinids. Cranberry Lake, July 28, 1917; Aug. 1, 1920. Wanakena, Aug. 1-7, 1920. Ranger School, July, 15, Aug. 12, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

Deltocephalus flavo-virens Gillette and Baker.

Cranberry Lake, Sept. 10, 1917. Ranger School, July 15, 1920. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

Deltocephalus nigriverter Sanders and DeLong.

In nursery at the Ranger School and on fine grass near Wanakena, July 15 and Aug. 12, 1920.

Euscelis striolus (Fallen).

This species is confined to the wet ground or boggy places adapted to certain coarse grasses to which the species seems restricted. Plains, Aug. 3, 1920. Barber Point, Aug., 1920.

Euscelis extrusus (Van Duzee).

Evidently prefers rather dry locations, rocky ridges or mounds where some grasses furnish its food supply. Cranberry Lake, Barber Point, July 20, 1917; July 28, 1919; July 3, 17, 1920. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

Euscelis deceptus Sanders and DeLong.

New to New York list. Wanakena (Ranger School), Aug. 12, 1920.

Euscelis uhleri (Ball).

A rather rare species in this locality and of little economic importance. Plains, Aug. 3, 1920.

Euscelis anthracinus (Van Duzee).

This very black species is by no means abundant but taken largely in low ground, the borders of bogs and in tote-roads. Evidently living upon the small grasses that have worked into the forest habitat. Cranberry Lake, Aug. 10, 1917; July 3, 1920. Wanakena, July and Aug., 1920.

Euscelis arctostaphyli (Ball).

Reported as occurring, but evidently not common in this locality. Plains, Aug. 3, 1920.

Euscelis humidus (Osborn).

Apparently restricted entirely to the bog association and taken with the fine grasses which furnish its food support. Cranberry Lake, Barber Point, July, 1920. Wanakena, Aug. 12, 1920.

Euscelis vaccinii (Van Duzee).

Another bog species apparently restricted very closely to Cranberry or possibly occurring on other plants of similar character. Barber Point, Aug., 1920. Plains, Aug. 3, 1920.

Euscelis instabilis (Van Duzee).

Common in boggy situations. Cranberry Lake, Aug. 5 and 10, 1917. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920.

Euscelis angustatus (Osborn).

In low ground on bog grasses and quite evidently limited to the bog association. Cranberry Lake, Barber Point, July and Aug., 1920. Grasse River, July 22, 1920.

Euscelis elongatus (Osborn).

Apparently rare as only a very few specimens have been taken. It was described from Maine where it occurred in similar boggy situations. Wanakena, Aug. 1-7, 1917.

Euscelis comma (Van Duzee).

Quite rare in this vicinity. Its food plant not noted but in Iowa it was taken on *Elymus*. Barber Point, July 5, 1920. Camp "tote road". Ranger School, July 15 and Aug. 12, 1920. Several specimens, including long and short winged females taken near Bean Pond in tote-road on low grass. Grasse River, July 22, 1920. Plains, Aug. 3, 1920.

Euscelis curtisii (Fitch).

This species is common throughout a large range of the country from Canada to the Carolinas. It is usually found in woodland tracts, generally where there is some moisture. Specimens have been taken at the camp in July and Aug., 1917 and 1920, also at various points in the higher ground around the Ranger School on Aug. 15, 1920, and at the top of Bear Mountain, Aug. 15, 1920, and upon other elevated crests. The species is of some economic importance.

Phlepsiuss decorus Osborn and Ball.

This species favors wet ground grasses but often taken on hill-sides around springs or in wet spots. A conspicuous instance is the taking of specimens on a high ridge in a very small patch of coarse grass and sedge at Cranberry Lake, Aug. 1, 1917; Aug. 5, 1920.

***Phlepsius maculellus* Osborn.**

This species which has been very rarely observed, was described from a single male specimen taken in Maine. A single specimen was taken in 1917 (Barber Point) and a few specimens the present season, Barber Point, Aug. 11, 1920, appear to be all that have been collected. It is restricted to boggy areas and lives on one of the fine grasses of the bog association. Barber Point, 1917; Aug. 11, 1920. Wanakena, Aug. 12, 1920.

***Phlepsius irroratus* (Say).**

This species is a very common one throughout the country on cultivated grasses and in meadows generally, but appears to be rare in this region; the only specimens taken are from the Grasse River, July 22, 1920, where there was an invasion of blue grass and timothy.

***Phlepsius apertus* Van Duzee.**

This species seems to replace the preceding one in the northern or woods region as it is found very plentiful in Maine in locations where *irroratus* would seem to be the natural member. It was taken along the tote-roads and in meadows and where these grasses have any value it may be considered of economic importance. Cranberry Lake, Sept. 15, 1917; Aug., 1920. Wanakena, Aug. 12, 1920.

***Phlepsius fulvidorsum* (Fitch).**

This is usually limited to the woodland associations but is taken in trails, roadways and on one occasion was taken at the Plains, Aug. 3, 1920, in a trail near open land but probably associated with nearby thickets. Barber Point, Aug. 1 and 18, 1917, and July, 1920.

***Phlepsius solidaginis* (Walker).**

In this region the species has been taken only in the higher stations but in association with sedges and wet land grasses. In general it is found in swampy or wet land associations. Barber Point, Aug. 5, 1920. Wanakena (French Camp), Aug. 12, 1920.

***Thamnotettix kennicotti* (Uhler).**

Both young and adult in this form have been frequently taken and while not absolutely sure as to all nymphs it seems to be one of the common species of the region. Cranberry Lake, Aug. 1, 1917; Aug. and July 28, 1919; reared Aug. 8, 1920; nymph common, Aug. 10, 1920. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920.

***Thamnotettix cockerelli* Ball.**

Heretofore recorded for Colorado and Maine. Swept at roadside probably from willow as its host plant in Maine was found to be *Salix rostrata*. The species is new to New York State list. Wanakena, Aug. 12, 1920.

Thamnotettix morsei Osborn.

A single specimen of this species has been found and its association is not known. Barber Point, Aug. 1, 1917.

Thamnotettix eburatus Van Duzee.

Only one locality, east from Barber Point, Aug. 11, 1920, is noted for this species and it is evidently quite rare. Its food plant is evidently the sweet gale as no other plant has been recognized in connection with it.

Thamnotettix belli (Uhler).

This is a northern and western species and not heretofore recorded for New York State. It has been recognized as most abundant in the Rocky Mountains. It occurs especially in woodland on undergrowth and this is considered as its definite habitat. Cranberry Lake, Aug. 1, 1917. Wanakena, July 15, 1920. Grasse River, July 22, 1920.

Thamnotettix belli var. **brunneus** Osborn.

This variety was described from Maine and has the same general association as the preceding species but differs particularly in the coloration. Wanakena, Aug. 1-7, 1917.

Thamnotettix waldanus Ball.

This is an inhabitant of the deep woods and has been found only on undergrowth in a dense forest and must be considered as restricted to this association. It was taken Aug. 29, 1920, especially among ferns but where maple seedlings and some other plants were present and it was hard to be certain of food plant.

Thamnotettix chlamydatus (Provancher)

This species has usually been taken on the borders of thickets or forest and was found along a woodland roadway on underbrush but its food plant is not definitely known. Plains, Aug. 3, 1920.

Thamnotettix pallidulus Osborn.

Cranberry Lake, July 17, 1920.

Thamnotettix cypraceus Osborn.

Differs from the typical form in lacking the tawny stripes on head and pronotum. Plains, Aug. 3, 1920.

Thamnotettix melanogaster (Provancher).

This is a very common species throughout the eastern part of the U. S. and found in patches of sedge or swamp grasses. Sedges are probably the usual host plant. Cranberry Lake, Barber Point, July and Aug. Grasse River, July 22, 1920.

Thamnotettix ciliatus Osborn.

Like other species of this group in the genus the species occurs in boggy places on sedge or coarse grasses. It is seldom taken but very likely occurs in abundance on a certain host plant at the proper season. Cranberry Lake (Hedgehog Pond), Aug. 11, 1920. Wanakena (Ranger School), Aug. 12, 1920.

Thamnotettix decipiens Provancher.

Common on marsh grass and sedges. The nymphs appear in late July and the adults in August and September, often in great abundance. Cranberry Lake, Aug. 1 and Sept. 15, 1917; July 30, 1920 (nymphs); Aug. 11, 1920 (adults). Plains, Aug. 3, 1920 (nymphs). Bear Mountain, Aug. 15, 1920.

Thamnotettix smithi Van Duzee.

This species seems to be much less abundant than *melanogaster* to which it is closely related. It occurs in low ground and in marsh upon grasses and sedges; it may be restricted to a certain species of food plant and consequently not often collected.

Thamnotettix placidus Osborn.

Fairly common though not abundant on marsh grasses and sedges of swamp meadow. Cranberry Lake, Aug. 1, 1917; July 28, 1919; July 30, 1920. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

Chlorotettix unicolor (Fitch).

This form has been taken at many different locations and may be considered as one of the important species of the region; its occurrence on grasses is sufficient to make it of economic importance where these grasses have any value. Both young and adults live upon the grasses of the swamp meadows and form one of the most conspicuous features of these associations. Cranberry Lake, July 24 and 28, 1919; Aug. 5 and Sept. 15, 1917. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920. Grasse River, July 22, 1920.

Chlorotettix lusorius (Osborn and Ball).

This species occurs in mixed grasses and sedges and so far as observed here prefers the higher locations but where there is considerable moisture and shade. It is too rare to be of economic importance. Barber Point, Aug. 5, 1920. Bear Mountain, Aug. 15, 1920.

Cicadula variata (Fallén).

Found only in wet shady woods on *Impatiens biflora* which is apparently its restricted host plant, at least for the nymphal stage. Cranberry Lake, Aug. 1, 1917; Aug. 10, 1920. Wanakena, Aug. 1-7, 1917.

***Cicadula 6-notata* (Fallén).**

This is one of the most widespread and abundant of the leafhoppers occurring throughout northern Europe and a large part of North America, feeding upon a great variety of grasses, including among the others oats and cereal crops. In cultivated areas the species has a very distinct economic importance. It has been found pretty plentiful on the wild grasses as well as blue grass and timothy of the camp sites and vicinity. Cranberry Lake, July 3 and 6, 1919; Aug. 1, 1917. Wanakena, Aug. 1-7, 1917; July 15, 1920; Aug. 12, 1920. Plains, Aug. 3, 1920.

***Cicadula pallida* Osborn.**

Has been taken very infrequently and only in bog associations where sphagnum and other distinctly bog plants occur. Cranberry Lake and Barber Point, Aug. 10, 1920. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920.

***Cicadula slossoni* Van Duzee.**

This species occurs in immense numbers and may be collected in boggy places. Wanakena and Ranger School, July 15; Aug. 12, 1920. Plains, Aug. 3, 1920.

***Balclutha punctata* (Thunberg).**

Cranberry Lake, July 3, 6 and 25, 1919; Aug. 5, 1917; June 9 and July 23, 1920. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Plains, Aug. 3, 1920.

***Balclutha impicta* Van Duzee.**

This is by no means as common as the preceding species and is distinguished from it simply by the absence of spots. Wanakena, Aug. 1-7, 1917.

***Alebra albostriella* (Fallén).**

This occasionally appears in large numbers on forest trees but has not been found abundant especially during the present season. Cranberry Lake, July 20, 1917. Wanakena, Aug. 1-7, 1917.

***Dicraneura cruentata* Gillette.**

Wanakena, July 15, 1920.

***Dicraneura mali* (Provancher).**

This is a meadow species, but it has not been found abundant in this region of Cranberry Lake.

***Dicraneura fieberi* (Loew).**

Occasionally found in abundance on low-ground grasses and in some cases possibly sufficiently to be serious. Cranberry Lake, July 6, 1917; Aug. 1, 1917. Plains, Aug. 3, 1920.

***Empoasca smaragdula* (Fallén).**

A common species in woodland, especially on poplars and willows. Cranberry Lake and Barber Point, on poplar, July 3, 1920.

***Empoasca aureoviridis* (Uhler).**

A very abundant form on willows and poplars, often so abundant that it must cause a considerable loss in the growth of the plant. Cranberry Lake, July 6, 7, 1917; Aug. 4, 1919. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

***Empoasca atrolabes* Gillette.**

A very abundant widely distributed species on *Alder*. Also taken on *Corylus* at Ranger School, July 15, 1920. Cranberry Lake and Barber Point, July 25, 1917; July 15-30, 1920. Wanakena, Aug. 1-7, 1917. Plains, Aug. 3, 1920.

***Empoasca coccinea* (Fitch).**

Very abundant on white pine and apparently limited to this tree except as occasionally adults have been taken on other plants in the same vicinity. Evidently of economic importance. Cranberry Lake, Aug. 8, 1917; July 8, 1919; July 8, 1920. Wanakena, July 29, 1920, on white pine in virgin forest.

***Empoasca flavescens* (Fabricius).**

A very widely distributed species in Europe and U. S., especially through southern states. Our specimens were taken at Wanakena (Ranger School), Aug. 12, 1920, in sweeping brush along trail.

***Empoasca birdii* Goding.**

Has been taken but rarely and its association has not been definitely placed. Cranberry Lake, July 5, 1917.

***Eupteryx vanduzeei* Gillette.**

Abundant on ferns, especially in shady woodland and a conspicuous member of the deep woods association; it has not been observed in more open land. Wanakena, Aug. 1-7, 1917; July 29, 1920 (deep woods on fern association).

***Eupteryx flavoscuta* Gillette.**

Commonly taken by sweeping ferns either in low-land bogs or hill forest and deep woods, undoubtedly feeding on fern. Cranberry Lake, July 20; Aug. 5, 1917; July 5, 1920. Plains, Aug. 3, 1920. Wanakena, Aug. 1-7, 1917; July 29, 1920 (abundant in deep woods).

***Eupteryx nigra* Osborn.**

This form has been merged as a variety under *flavoscuta* by McAtee and there are fairly good connecting forms but it is possible to find quite as complete intergradations with *vanduzeei*; both

forms seem to have well marked differences in habitat but not in host plant. Wanakena, July 29, 1920, in deep wood on fern associations.

***Typhlocyba querci* (Fitch).**

This species was described from oak, but it has a wide variety of host plants and in this region it must survive entirely on other species as the oaks are absent. It is sufficiently abundant to cause a definite drain upon the trees affected and does not seem to have any close limitations and habitat as it may be taken at various levels on birch and other trees. Cranberry Lake, July 25, 1917; July 10, 1920. Wanakena, Aug. 1-7, 1917; July 15, 29, 1920.

***Typhlocyba querci* var. *bifasciata* Gillette and Baker.**

This variety, like the previous species, appears to have a wide range of food plants but has been noted as even more abundant than the species above. Cranberry Lake, Aug. 1, 1919; July 2, 25, 1920 (adult); Aug. 13, 1920. Wanakena, Aug. 1-7, 1917.

***Typhlocyba lethierryi* Edwards.**

This has been taken only twice and is probably quite rare. Cranberry Lake, Barber Point, Aug. 5, 1920. Wanakena, July 29, 1920. One specimen (Wanakena), probably to be placed here, has distinct black dot on inner cross nervure.

***Typhlocyba tenerrima* (Herrich-Schæffer).**

Very rare, as only a very few specimens have been found, but these have been collected in the woodland associations, generally where there is considerable moisture. Cranberry Lake, July 25, 1917; July 12, 1920. Wanakena, Aug. 1-7, 1917.

***Typhlocyba rosae* (Linnaeus).**

This is a very abundant species on roses throughout the country; it occurs in this region on different forest trees but never in great abundance. The species is apparently capable of living in varied conditions although limited to thickets or woodlands where it has both shade and moisture. Barber Point, Aug. 13, 1920. Plains, Aug. 3, 1920.

***Typhlocyba comes* var. *comes* (Say).**

Taken only rarely and then from trees along tote-roads. Barber Point, Aug. 5, 1920.

***Typhlocyba comes* (Say) var.**

Cranberry Lake, July 18, 1917.

***Typhlocyba commissuralis*.**

Cranberry Lake, July 30, 1920.

***Typhlocyba obliqua* (Say).**

This species has been taken from a variety of trees but the nymphal stage has been observed only on fire cherry, which may be considered as at least one of its host plants. It is hardly abundant enough to be counted of much importance. Cranberry Lake, Aug. 1, 1917. Wanakena, Aug. 1-7, 1917; Aug. 12, 1920. Plains, Aug. 3, 1920.

***Typhocyba obliqua* var. *noevus* Gillette.**

Wanakena, Aug. 1-7, 1917.

***Typhocyba obliqua* var.**

Cranberry Lake, June 9, 1920.

Family FULGORIDAE***Scolops sulcipes* (Say).**

This is a common species in meadow associations of eastern United States but only one capture has been recorded for this region. The Plains, Aug. 25, 1920.

***Elidiptera slossoni* Van Duzee.**

Breeds in dead (rotten) spruce and white pine; a more detailed account of this species is given under life history. Barber Point, 1917. Proulx's Lumber Camp, July 18, 1920.

***Cixius misellus* Van Duzee (Fig. 19, b).**

Like the preceding species this insect occurs in the forest associations especially among conifers and its nymphal stages are probably associated with such trees. Cranberry Lake, Aug. 6, 1917. Plains, Aug. 3, 1920. Wanakena (Ranger School), Aug. 12, 1920.

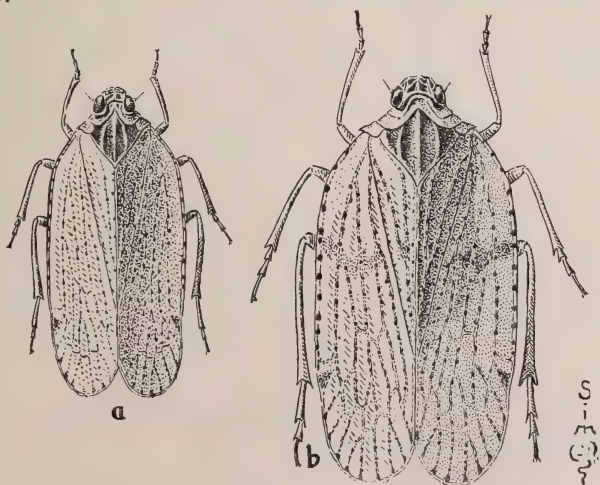


Fig. 19.—a, *Cixius pini* F L; b, *Cixius mesellus* Van D.

Cixius pini Fitch (Fig. 19, *a*).

Found among conifers especially spruce and usually in places where the spruce is bordered by boggy conditions. It seems probable that the larvae may be limited to some of the conifers for their support. Cranberry Lake, Aug. 2, 1917. Grasse River, July 22, 1917. Plains, Aug. 3, 1920. Ranger School, Aug. 12, 1920.

Bruchomorpha oculata Newman (Fig. 20, *b* and *c*).

This appears to be the most abundant species of the genus for this region and was taken in greatest abundance on the campus of the Summer Camp. Cranberry Lake, July 29-30, 1920. Wanakena, Aug. 12, 1920.

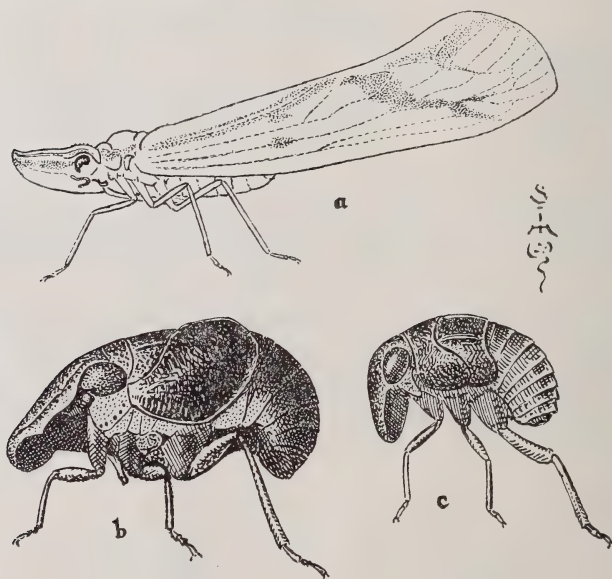


Fig. 20.—*Bruchomorpha oculata* Newman: *a*, adult; *b*, nymph; *c*, *Otiocerus coquebertii* Kirby — side view of adult.

Aphelonema histrionica (Stal.).

This has been taken most commonly in connection with the plants associated with the snowberry but probably the fine grasses of the bog association furnish its food supply. Cranberry Lake and Barber Point, Aug. 10, 1920. Wanakena, Aug. 12, 1920.

Otiocerus coquebertii Kirby.

This appears to be quite rare in this region as only a very few specimens have been taken. Barber Point, July 20, 1917. Wanakena, Aug. 12, 1920 (Fig. 20, *a*).

Laccocera vittipennis Van Duzee.

This is a very common form in swampy regions and was taken in greatest abundance at the Plains in the areas where there has evidently been little change of conditions for a long lapse of time. The food plant is probably some of the fine grasses but no particular species has been determined. Plains, Aug. 3, 1920.

Stenocranus dorsalis (Fitch).

Common to wide extent of eastern United States, but apparently much less common here than the following species. Barber Point, July 25, 1917.

Stenocranus felti Van Duzee.

Common to the northern woodlands where open sedge-covered spots are found. Cranberry Plains, Aug. 3, 1920.

Kelisia axialis Van Duzee.

Usually rather rare and found on sedge in lowland or swampy places. Barber Point, Aug. 17, 1919; Aug. 13, 1920.

Pissonotus dorsalis Van Duzee.

Taken at lower levels in grassy places. Plains, Aug. 3, 1920. Barber Point, Aug. 1, 1917.

Pissonotus ater Van Duzee.

Barber Point, 1920.

Liburniella ornata (Stal).

This handsome little species was taken in small numbers in low grass lands. Cranberry Lake, July 5, 1920. Plains, Aug. 3, 1920.

Liburnia pellucida Fabricius.

A cosmopolitan species common to grass lands especially in more humid localities, but taken only rarely in this region. Plains, Aug. 3, 1920.

Liburnia puella Van Duzee.

This is one of the smallest species of the group, but often occurs in large numbers. It is confined to grassy, moist locations. Barber Point, Aug. 6, 1920.

Liburnia campestris Van Duzee.

An abundant species of wide range and no doubt a source of loss in meadows and pastures. Cranberry Lake, June 9, 1920. Wanakena, Aug. 1-7, 1917.

Liburnia lutulenta Van Duzee.

A common widely distributed species. Barber Point and Wanakena, 1920.

Family APHIDIDAE

This large and exceedingly important family has been given less attention than some of the other families, partly because the most important species have received extended investigation, partly due to the effort to clean up details of life history for some of the destructive but little known species in other families. No attempt has been made to collect the species occurring in the Cranberry Lake region.

The group is of remarkable interest on account of its unusual mode of reproduction, its enormous rate of multiplication and the many puzzling phases of its attacks on different hosts, seasonal migrations, alternate hosts, etc., which cannot be taken up in detail within the limits of this paper.

Ecologically, they may be characterized as uniformly plant feeders. Most of the species, practically all for this region, attack leaves, twigs or smaller branches. They multiply so rapidly and form such large colonies that the drain on the plant from the constant sucking of sap frequently results in wilting or withering of plant infested. Such species as the Pine chermes, Alder blight



Fig. 21.—Alder blight, *Pemphigus tessellata*: a, much enlarged; b, about natural size. Photo by Drake and Fivaz.

and Beech blight become very conspicuous on account of the formation of great quantities of cottony or wooly covering, the waxy filaments being secreted by special wax-glands of the dorsal part of the body (mainly located on back of abdomen).

One of the ecologic associations of special interest is found in the very frequent, almost universal, presence of ants attending the colonies of aphids, the ants utilizing the "honey dew" secretion from the aphids as food. The numerous predaceous and parasitic insects assisted by spiders and birds destroy immense numbers of plant lice and thus the enormous reproductive powers of the aphids are counterbalanced and kept down to such an extent that the plants on which they feed have some show of survival.

Hormaphis papyraceae lives on willow birch and corresponds well with the description of gall by Oestlund. The galls consist of a distinctly corrugated structure between the leaf veins and contains numerous dark brown or black aphids. *Callipterus betulaecolens* (alate individuals, and various sizes of nymphs and wingless adults) were found in some of the galls occurring on yellow birch leaves, but more commonly entirely independent of the galls and evidently in the galls by accident.

Family CHERMIDAE

These interesting little insects form a quite conspicuous element in the insect fauna of the Cranberry Lake region, especially *Psyllia floccosa*, *trimaculata* on fire cherry, and *carpinicola*, apparently on numerous host plants, being taken in immense numbers. All the species are leaf feeders, living on the under surface of the leaves. The common gall making species occurring on hackberry trees are wanting here as the host plant does not occur.

A very striking feature is presented in the white cottony masses covering the bodies of the nymphs in *P. floccosa* on alder and *P. 3-maculata* on fire cherry. The latter form may be counted as destructive and merits a more detailed study of life history and ecology for economic reasons.

Aphalara veaziei Patch.

Cranberry Lake, July 5, 1920; June 9, 1920.

Trioza nigrilla Crawford.

This species is widely distributed and a fairly common species on willows. Cranberry Lake, Aug. 4, 1919.

Psyllia striata (Patch.)

I refer here a very abundant species occurring commonly on yellow birch, but as adult found on a wide variety of plants. Nymphs with small flocculent covering have been noted on birch leaves, but I have not verified the connection. Evidently very close to *carpinicola*. Cranberry Lake, July 2-25, 1920.

Psyllia carpinicola (Crawford).

The species occurs in great abundance and a great variety of trees, but was especially plentiful as adults on yellow birch, white pine and fire cherry. Barber Point and Cranberry Lake, July 8, 14 and 28, 1919; July 8-25, 1920.

Psyllia floccosa Patch.

Cranberry Lake, Barber Point, Plains, Childwold and Ranger School in abundance on alder. Agrees with description of *floccosa*, especially in genitalia. No nymphs with flocculent covering seen on alder at camp, but these may have matured before my arrival. The Ranger School specimens were taken in alder clump on rocky hillside which was very moist during July and August, 1920.

Psyllia 3-maculata Crawford (Figs. 42 and 43).

A very abundant form on great variety of plants in adult stage. Nymphs, the flocculent form, are very abundant on *Prunus pennsylvanica*. The adults have more or less varying shades of yellow to red on thorax (*trimaculata*—see life history notes).

HETEROPTERA IN THE VICINITY OF CRANBERRY LAKE

BY CARL J. DRAKE

Family SCUTELLERIDAE**Homaemus aeneifrons** (Say) (Fig. 22, b)

This insect is the most common species of the *Scutelleroidea* occurring in the vicinity of Cranberry Lake. Nymphs and adults have been taken during June, July, August and September, but most of the immature forms attain the adult state before September. The species is quite generally distributed, but it is by far more abundant in the neighborhood of low marshy meadows and swamps. Van Duzee (*l. c.*, p. 548) states that the insect is very generally distributed and common in the Adirondacks where there were low, marshy spots with carices intermixed with swampy grasses. He took an adult upon a species of *Scripus* on the summit of Cobble Hill.

This *scutellerid* is quite variable in both size and color. The color varies from pale yellow or dull to quite dark or blackish forms. The dull or glossy or pale color-forms are often more or less variegated with fuscous or black, thus giving the insect a marbled appearance. The size ranges from 6.5 mm. to 9.5 mm. in length.

Eurygaster alternatus (Say).

Four specimens, taken at Wanakena and Barber Point near a grassy bog in an old burn. Osborn collected a specimen while sweeping in the Grasse River Bog.

Family CYDNIDAE**Thyreocoris ater** (Amyot and Serville).

Two specimens: Barber Point and Wanakena, July, 1920.

Thyreocoris pulicarius (Germar).

One specimen, taken on grass, July 30, at Wanakena in an old burn.

Sehirus cinctus (Palisot de Beauvois) (Fig. 22, *a*).

Barber Point, Wanakena and the Plains. This insect is not uncommon and feeds upon weeds growing in small open areas. Specimens have been collected during June, July, August and September.

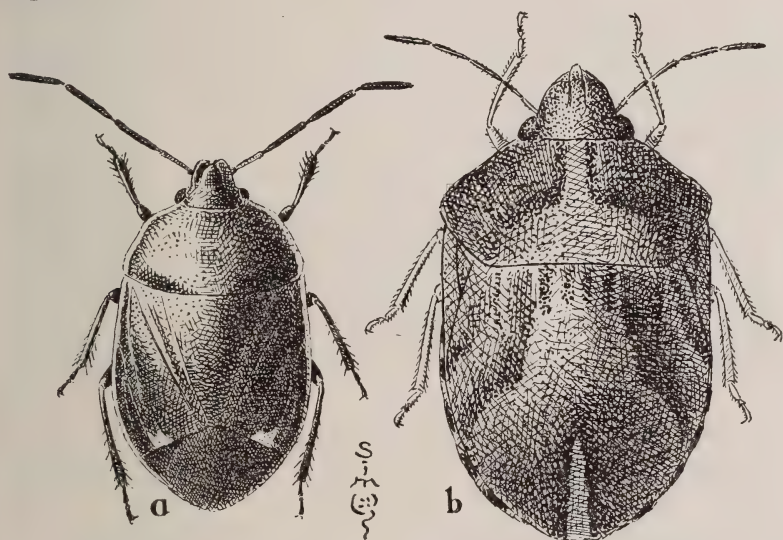


Fig. 22.— *a*, *Homaemus aeneiformis* (Say); *b*, *Sehirus cinctus* P. B.

Family PENTATOMIDAE**Sciocoris microphthalmus** Flor.

Eight specimens, taken during July and August while sweeping grasses and rank weeds at Barber Point and Wanakena. I have very carefully collated the specimens with a male and female in the late Puton's collection (from Paris Museum) and find the American specimens identical with European examples determined by the late Puton. This seems to be the only record for New York State. The insect has been recorded for Ontario, New Hampshire, Maine, Michigan and Minnesota.

Peribalus limbolarius Stal.

One example, collected at the Plains, July, 1920.

Chlorochora uhleri Stal.

Crataegus Hill at Barber Point and Plains during August, 1920. This is not a common species in the vicinity of Cranberry Lake.

Mormidea lugens (Fabricius).

Common: Barber Point, Wanakena and the Plains during July, August, and September, 1917, 1919, and 1920. Numerous specimens were observed breeding and feeding on mullein, *Verbascum Thapsus* Linn. at the Forestry Camp. Many examples were also collected while sweeping various herbaceous plants.

Euschistus euschistoides (Vollenhoven).

Barber Point, Wanakena, Plains and Conifer. This insect seems to be a general feeder upon many herbaceous plants and sometimes on birch, beech and poplar trees. It hibernates in the adult state. The eggs are frequently parasitized by a small hymenopterous parasite.

Euschistus tristigmus (Say).

This is the most common pentatomid in the vicinity of Cranberry Lake and is found during the entire summer. It is a general feeder upon herbaceous plants and also frequently breeds on trees (white and yellow birch, ironwood, poplar, beech and maple). Adults and nymphs have also been collected on the blossoms of wild spiraea (*Spiraea lalifolia* Borkh.). Several adults were taken bearing tachinid eggs, but the parasite failed to develop in the laboratory. Hymenopterous parasites have reared from its eggs.

Euschistus variolarius (Polisot de Beauvois).

Wanakena and Barber Point, July and August, 1919 and 1920. Not common.

Coenus delius (Say).

One adult and several large nymphs were collected while sweeping grasses and weeds in a semi-marshy place near a small stream in the Plains during the last week of July, 1920.

Neottiglossa undata (Say).

Common: Barber Point, Wanakena, Conifer and the Plains during June, July and August, 1920. It is found on herbaceous plants.

Cosmopepla bimaculata (Thomas).

Common on weeds and rank vegetation. Adults and nymphs were noted at various times during the summer feeding on mullein.

Thyanta custator (Fabricius).

An adult and several nymphs were collected at the Plains, Crataegus Hill and Barber Point, 1920.

Banasa dimidiata (Say).

Very common: Barber Point, Wanakena, Plains, Crataegus Hill, and Conifer. Adults and nymphs have been found on yellow birch, beech and also on various herbaceous plants. The eggs are frequently parasitized by a small hymenopterous parasite.

Meadorus lateralis (Say) (Fig. 23, b).

This is largely a tree-inhabiting species. Specimens have been observed depositing eggs on yellow birch and beech at Barber Point during June, July, and August. The winter is spent in the adult state. My records indicate two generations a year during the summers of 1919 and 1920.

Nymphs and adults were taken in the tops of large yellow birch trees (felled for catkins while studying the insects affecting reproduction of yellow birch) in the vicinity of Barber Point during July, August and September, 1920, by Mr. Eric Johnson and the writer. In some very tall trees many nymphs, representing three or four instars, and adults were feeding on the leaves and catkins. Adults were also reared from eggs and nymphs (taken from the tree tops) on catkins placed in glass breeding cages in the insectary. *M. lateralis*, although sometimes taken while sweeping herbaceous plants, is primarily a tree-inhabiting species. It also breeds on white birch and beech trees.

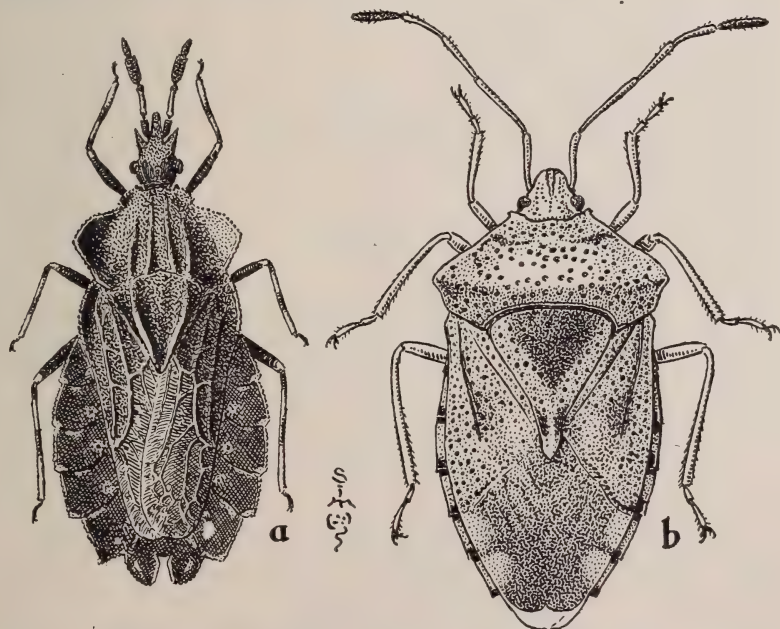


Fig. 23.—a, *Aradus quadrilineatus* Say; b, *Meadorus lateralis* (Say).

Elasmotethus cruciatus (Say).

Barber Point and Wanakena, August, 1917, 1919, and 1920.

Elasmotethus atricornis (Van Duzee).

Barber Point, August, 1920.

Mineus strigipes (Herrich-Schaeffer).

Four examples, collected at Barber Point, July 19 and 26, 1920, and one specimen at Wanakena, August 1, 1917.

Perillus circumcinctus Stal.

Two examples, Wanakena, July 30, 1917, and two specimens at Barber Point, August, 1920.

Perillus exaptus Say, var. *d* Van Duzee.

A single specimen of this variety was taken while sweeping rank vegetation near a small stream in a semi-aquatic place in the Plains, August, 1920. Van Duzee lists var. *d*. from Colorado and Washington. The typical form is a widely distributed species, extending from Vancouver to Quebec and southward to Colorado, New Mexico and New Jersey (*vide* Van Duzee).

Podisus serieventris Uhler.

Abundant: Barber Point, Plains, Wanakena, Floating Island, Buck Island and Conifer, June, July, August and September, 1917, 1919 and 1920.

Podisus modestus (Dallas).

Common: Barber Point, Wanakena and Plains, June, July, August and September, 1917, 1919 and 1920.

Podisus placidus Uhler.

Several specimens: Barber Point, Plains and Wanakena, June, July and August, 1917, 1919 and 1920.

Podisus maculiventris (Say).

Barber Point and Wanakena, 1917, 1919 and 1920. Osborn found a specimen on yellow birch feeding upon a frog-hopper, *Clastoptera obtusa* (Say) and the writer took a specimen on a willow tree with its beak impaled in a lampyrid beetle.

Family COREIDAE**Protentor belfragei** Haglund (Fig. 24, *a*).

This specimen seems to be more or less locally distributed in small, grassy areas, but frequently abundant in these habitats. Wanakena (on an open grassy hill side at "French Camps"), Barber Point and Plains, July, August and September, 1917, 1919 and 1920. This is the most common coreid taken in the vicinity of Cranberry Lake.

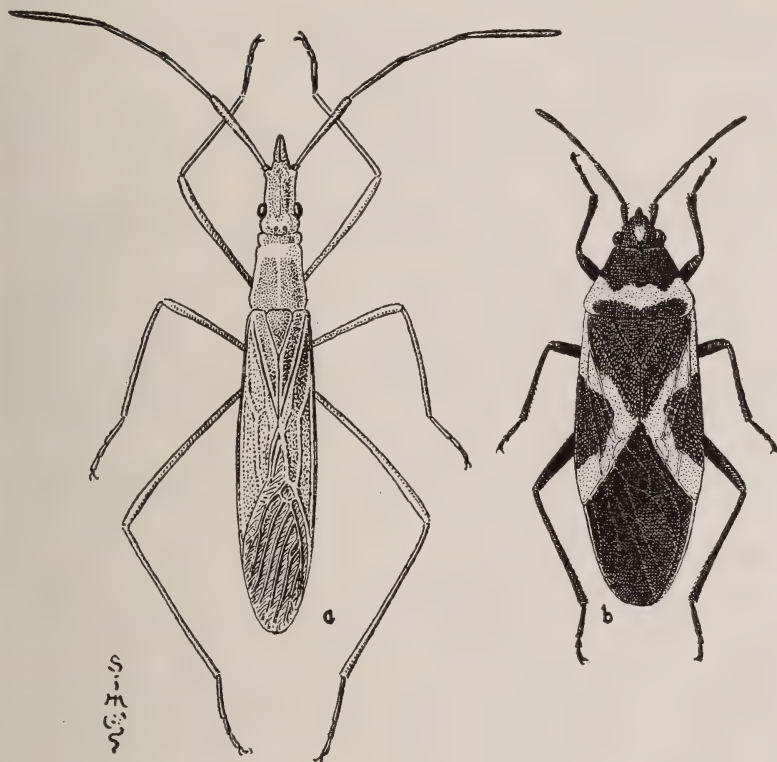


Fig. 24.—a, *Protentor belfragei* Haglund; b, *Lygaeus kalmii* var. *angustomarginatus* Parsh.

***Alydus eurinus* (Say).**

Two specimens: Barber Point and Wanakena, July, 1919 and 1920.

***Alydus conspersus* Montadon.**

Several specimens: Barber Point, Wanakena and Plains, 1917, 1919 and 1920.

***Corizus crassicornis* (Linnaeus).**

Numerous specimens: Barber Point, Wanakena and the Plains during July and August, 1917, 1919, and 1920.

***Corizus lateralis* (Say).**

Two specimens, collected at Barber Point, July 1, 1920.

Family ARADIDAE

***Aradus quadrilineatus* Say (Fig. 23, a).**

Several specimens: Two adults and a few nymphs, representing three instars, were found under the bark of a decaying beech log at Barber Point during July by Osborn; one specimen between

the crevices of the bark of a recently felled yellow birch tree, Barber Point, August, 1919; Mr. Fivaz took two specimens on the window of the insectary, June 27, 1920.

Aradus robustus Uhler.

One specimen, taken on a yellow birch log, July 19, 1919.

Aradus ornatus Say.

One specimen, collected on the window of the insectary, July 20, 1920.

Aradus similis Say.

Common, Barber Point and Wanakena. This insect breeds in the crevices of the bark of dead spruce and hemlock. Eggs, nymphs and adults were taken during the summers of 1917, 1919 and 1920.

Aradus similis centriguttatus Bergroth.

Taken with the typical form on spruce and hemlock, Barber Point, 1920.

Aradus tuberculifer Kirby.

Barber Point, July 24, 1917; taken about noon as the insect happened to alight on the side of a tent.

Aradus lugubris Fallen.

Several specimens, taken on the windows of the insectary during July, 1919 and 1920. One specimen collected on a yellow birch log at Barber Point, June 25, 1919.

Aradus lugubris var. **nigricornis** Reuter.

Taken with the typical form on the windows of the insectary at Barber Point.

Aradus abbas Bergroth.

Barber Point, June 17 and July 26, 1919; collected on a tent at camp.

Aradus proboscideus Walker.

Three adults and many nymphs, taken in the crevices and beneath the bark of an old dead spruce tree at Barber Point (in Beaver Meadow), July 9, 1917.

Aradua niger Stal.

Several specimens collected by Mr. Hide and the writer on a pine log at Barber Point, July 10, 1917.

Aneurus inconstans Uhler.

Barber Point, June and July, 1919. One specimen was found on an old yellow birch log, near the Beaver Meadows, June 26, 1919.

Aneurus simplex Uhler.

Many specimens, taken at Barber Point beneath the loose bark of a small dead beech tree, July 20, 1917. Fivaz found a specimen on a spruce log, at Barber Point, July 22, 1920. Numerous specimens were taken on the windows of the insectary at various times (of the days) during the summer of 1920.

Family NEIDIDAE**Neides muticus** (Say).

Several examples, taken at Wanakena, Barber Point and Plains during July and August, 1917, 1919 and 1920.

Family LYGAEIDAE**Lygaeus kalmii** Stal subsp. **angustomarginatus** Parshley (Fig. 24, *b*).

Common on the ground at Barber Point during July and August, 1919 and 1920. A couple of specimens were also collected at Wanakena, August, 1920 (*vide* Parshley).

Ortholomus longiceps (Stal).

Very common in open areas on rank grasses and weeds at the Plains and on Big Floating island during July and August, 1920. Several specimens: Wanakena, July and August, 1917.

Nysius thymi (Wolff).

Common: Wanakena, Barber Point and the Plains, June, July and August, 1919 and 1920.

Nysius ericae (Schilling).

Common: Barber Point and Wanakena, July and August, 1917, 1919 and 1920.

Ischnorrhynchus geminatus (Say) (Plate 11, Fig. *g*).

Very abundant, especially in swampy and marshy areas; Barber Point, Wanakena, Conifer Plains and "Big Floating island." Numerous specimens were also found during July and August, 1919, on the tops of large yellow birch trees. Specimens were bred from both yellow and white birch catkins in breeding stages during July, August and September, 1919, by Mr. Eric Johnson and the writer.

Cymus luridus Stal.

Barber Point and Wanakena during July, 1917.

Cymus angustatus Stal.

Very abundant during June, July and August, 1917, 1919 and 1920, at Barber Point, Wanakena and the Plains. The insect was collected by sweeping grasses and herbaceous plants.

Cymus discors Horvath.

Common during the entire summer: Barber Point, Wanakena, Plains and Conifer. Most of the specimens were taken in open areas on rank vegetation and in swampy places. A few specimens were collected on *Salix* spp.

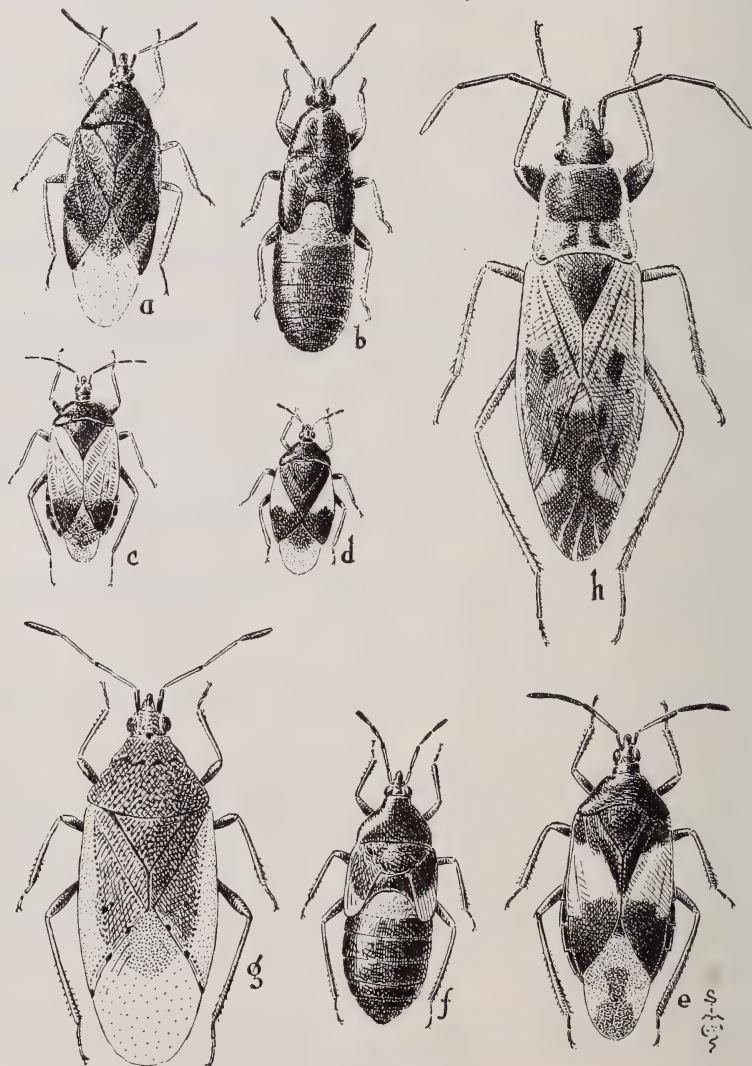


Plate II.

a, *Tetraphleps osborni*, n. sp.; b, *Anthocoris* ? sp. ? c, *Asthenidea temnostethoides* Reut.; d, *Triphleps insidiosus* Say; e, *Anthocoris borealis* Dall.; f, *A. borealis*, last instar; g, *Ischnoshynchus geminatus* Say; h, *Eremocoris ferus* (Say).

***Geocoris bullatus* (Say).**

Barber Point, July, 1917.

***Geocoris uliginosus* (Say).**

Several specimens, collected in open areas at the Plains, July, 1920.

***Geocoris uliginosus lateralis* Fieber.**

Wanakena, August 12, 1920, in the "old burn" back of the Ranger School.

***Phylegas abbreviatus* (Uhler).**

Four specimens, taken at the Plains, August 2, 1920.

***Oedancala dorsalis* (Say).**

Wanakena, July, 1917, sweeping weeds and grasses.

***Crophius disconotus* (Say).**

Numerous specimens, sweeping rank vegetation in open areas at the Plains, August, 1920.

***Myodochnus serripes* Oliver.**

Wanakena, July, 1917.

***Ligyrocoris diffusus* (Uhler).**

Very common in open areas: Barber Point, Plains, Wanakena and Conifer during the summers of 1917, 1919 and 1920.

***Ligyrocoris contractus* (Say).**

This insect, like *L. diffusus* Uhl., could always be found on herbaceous plants in open areas at Barber Point, Plains, Conifer and Wanakena.

***Perigenes constrictus* (Say).**

One specimen, collected at the Plains, August 29, 1920.

***Antillocoris pallidus* (Uhler).**

One specimen, Wanakena, Aug. 1-7, 1917.

***Stygnocoris rusticus* Fallén.**

Two specimens, Barber Point, August 1, 1917.

***Eremocoris ferus* (Say) (Plate 11, Fig. h).**

Four specimens on yellow birch, Barber Point, July 21, 1919. One specimen, July, 1917, beneath the loose bark of a balsam stump at Wanakena. The latter specimen had just moulted and was not fully colored at the time of capture. Two specimens were taken at Conifer (September, 1917) beneath the loose bark of an old yellow birch stump by Mr. Johnson and the writer.

Family PIESMIDAE***Piesma cinerea* Say.**

One example, taken "in flight," Barber Point, July, 1919, at noon in the mess hall, by Mr. Marquardt.

Family TINGITIDAE***Corythucha pergandei* Heidemann.**

Common on alder, taken at Barber Point, Plains and Wanakena during the entire summer. This species spends the winter in the adult state; there are two generations a year in the Adirondacks.

***Corythucha bellula* Gibson.**

Common on alder, but not taken in the same association with *heidemanni*. Barber Point and Wanakena, June, July and August, 1917, 1919 and 1920.

***Corythucha marmorata* Uhler.**

Not common, swept from weeds at Barber Point, July, 1920.

***Corythucha mollicula* Osborn and Drake (Fig. 25, *c* and *d*).**

Common on various species of willow, but not as abundant as *elegans* Drake. Barber Point, Plains, Conifer and Wanakena during the entire summer. This insect also hibernates during the

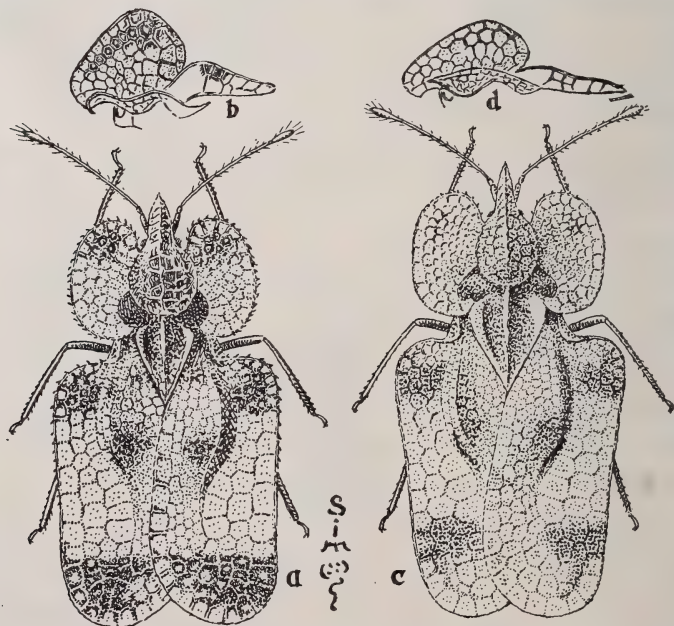


Fig. 25.—*a* and *b* (lateral view of hood and median carina), *Corythucha elegans* Drake; *c* and *d* (lateral view of hood and median carina), *Corythucha mollicula* O. & D.

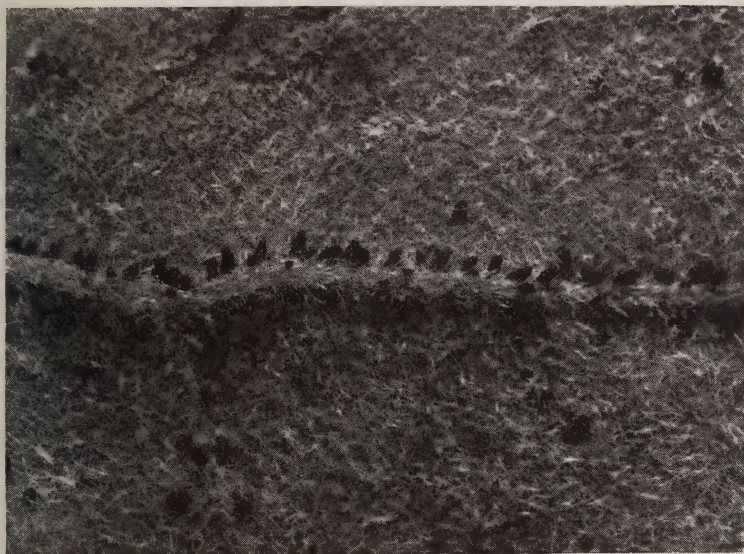


Fig. 26.—Eggs of *Corythucha elegans*. Photo by Drake.

winter in the mature state. *Salicis* Osborn and Drake and *canadensis* Parshley are synonyms of this species. It is very variable in size and somewhat in color.

Corythucha elegans Drake (Fig. 25, *a* and *b*; Fig. 26, eggs).

Taken on *Salix* spp. at Barber Point, Wanakena, Plains and Conifer. This species and the following, *C. pallipes* Parshley, are by far the most abundant species of *Heteroptera* living in the vicinity of Cranberry Lake. It is not uncommon to find the leaves of badly infested trees greatly discolored and almost entirely destroyed by their feeding punctures. *Elegans* also hibernates in the adult state. The nymphal stages are represented by five instars and there are two generations a year at Barber Point. The eggs are laid in irregular rows on the ventral side of the leaves along either or both sides of the principal veins. The nymphs feed in clusters during the early stages. Occasionally the species breeds on poplars, *Populus tremuloides* Michx. and *Populus grandidentata* Michx. A few seedlings of the large-tooth poplar were very badly infested during the past summer, 1920, at Barber Point, but willow seems to be the preferred food-plant. *Anthocoris borealis* and the larvae of a lace-wing fly, *Chrysopa* sp. were observed preying upon this insect in the field.

Corythucha pallipes Parshley (Plate IV, Fig. 44).

This insect is usually found in immense number on yellow birch in the vicinity of Cranberry Lake. It also breeds on white birch, beech, ironwood and occasionally on mountain ash and hard

and soft maple. *C. betulae* Drake and *C. cyrta* Parshley are synonyms of this species. The life history of *pallipes* is discussed in another paper in this bulletin.

Galeatus peckhami Ashmead (Plate V).*

About 200 specimens, taken upon aster, *Aster macrophyllus*, and boneset, *Eupatorium* sp. at Barber Point (summit of Crataegus Hill) during the last week of July and August, 1920, by Dr. Osborn and the writer. The life history of this insect is also discussed in another paper herein.

Melanorhopala clavata Stal.

Several specimens, taken near a small stream on tall weeds at the Plains during the latter part of August, 1920.

Family REDUVIIDAE

Reduvius personatus (Linnaeus).

One specimen, collected at Indian Mountain House, near Barber Point, by Mr. Leland Slater, 1920.

Sinea diadema (Fabricius).

Common: June, July, August and September at Barber Point, Wanakena, Conifer, Childwold and the Plains, 1917, 1919 and 1920.

Family CIMICIDAE

Cimex lectularius (Linnaeus).

This pest is sometimes very common in old houses, hotels and lumber camps. Its ability to undergo long fasts frequently enables the insect to maintain itself in camps and dwellings not inhabited during the entire year. It is sometimes a serious pest in lumber camps in the vicinity of Cranberry Lake, the crevices between the logs offering a very favorable hiding and breeding place. While riding on the train between Conifer and Cranberry Village the writer found a specimen crawling about on a seat in the day coach.

Family ANTHOCORIDAE

Asthenidea temnostethoides Reuter (Plate II; *e*, adult).

Two specimens, collected at Barber Point, Sept. 16, 1917, and August 5, 1920. Van Duzee gives its habitat as Illinois (*vide* Barber).

Anthocoris borealis Dallas (Plate II; *e*, adult, and *f*, nymph in last instar).

This predator is common in eastern United States and Canada. My records indicate that it is primarily a tree-inhabiting species and preys largely upon leaf-feeding insects. It shows a decided preference for deciduous leaf-destroying insects and seems to be

* See footnote, p. 105.

by far most common on willow. Many adults and nymphs, representing three or four instars, were collected on *Salix* spp. during the summers of 1917, 1919 and 1920. Adults have been observed in the field with their beaks impaled in *Corythucha elegans* Drake, *C. mollicula* O. & D. and *C. pallipes* Parshley. The writer has also found the insect in the egg-galleries of several bark beetles (Ohio Journal Science, Vol. XXI, pp. 201-206, 1921), but it does not seem to breed or normally live there. Field observations during the summers of 1919 and 1920 show only one generation a year, the first adults beginning to emerge about the middle of July. Only the larger nymphs and adults were collected during the latter part of the summers.

Anthocoris — sp. (Plate II; *b*).

This peculiar and very interesting insect was only taken in the nymphal stages. It lives largely in the burrows of bark and ambrosia beetles or in the crevices and beneath the scales of the bark of coniferous trees, particularly spruce. It is rarely found in the galleries of *Ipidae* in hardwoods. Specimens (Drake, Ohio Journal of Science, Vol. XXI, pp. 201-206, 1921) have been found in the burrows of *Polygraphus rufipennis* Kirby, *Dryocoetes piceae* Hopkins, *Dryocoetes americana* Hopkins, *Orthotomicus caelatus* Eichlr., *Trypodendron bivittatum* Kirby, *Ips pini* Say, *Pityogenes hopkinsi* Swaine, *Trypodendron betulae* Swaine, *Anisandrus obesus* Le Conte and *Xyloterinus politus* Say. Four distinct nymphal stages were found in the burrows of *Polygraphus rufipennis*, *Dryocoetes americana* and *Orthotomicus caelatus* in spruce logs that had been felled during the previous winter (1919). Only very young nymphs, probably the second and third instar were found during the latter part of May and forepart of June; later in the summer only the large nymphs were collected. Nymphs, probably in the last two instars, were placed in breeding cages at Barber Point and then carried to Syracuse about the first of September. These specimens were fed small insects, but they all died before they reached the mature state. Records seem to indicate that the adult state is probably found during the late fall. Numerous specimens taken in the field about the first of September, 1920, were mostly in the last instar. The insect is undoubtedly an important enemy of both bark and ambrosia beetles, also other small and very young larvae of wood-destroying insects. In the breeding cages the nymphs readily feed upon small larvae and insects, also upon dead larvae and dead insects.

Tetraphleps osborni n. sp. (Plate II; *d*).

Head, thorax and abdomen dark piceous and shining. Abdomen beneath dark piceous sometimes slightly tinged with reddish brown, the pubescence sparse and grayish. Hemelytra brown or dark brown, with greater part of embolium and cuneus lighter; membrane smoky, usually with pale streaks following the nervures. Pubescence fine, slightly curled, pale. Antennae dark brown, the

second segment lighter; third and fourth segments subequal in length; second segment equal to the first and third conjoined, the first slightly more than half the length of the third. Legs with basal portion of femora and tarsi dark brown to nearly black, the rest lighter.

Pronotum with explanate margins narrow, distinctly and roundly emarginate on the posterior border, distinctly and transversely rugulose on the collum and basal portion, a smooth somewhat crescent-shaped area just back of the collum, the pubescence grayish, fine and mostly prostrate. Rostrum reaching between the middle coxae. Head quite sparsely pubescent, its length distinctly longer than its width (diameter through eyes). Male genital elaspers curved. Length 3.2 — 3.45 mm.; width 1.15 — 1.27 mm.

Numerous specimens, taken on white pine trees, at Barber Point, Wanakena and the Plains during July, August and September, 1917, 1919 and 1920. The male is a little more slender than the female. This insect seems to feed largely upon the leaf-feeding insects of conifers, particularly white pine, *Pinus strobus*. Nymphs and adults could be found at all times during the summer upon the pine trees but only larger nymphs and adults during the latter part of the season. There is only one generation a year. The insect has been bred from the burrows of *Cryptorhynchus lapathi* by the writer (l. c., p. 203). I am indebted to Dr. H. M. Parshley for kindly comparing this insect with his types of *T. concolor* and *T. americana*.

Triphleps insidiosus (Say) (Plate II; *a*).

This is a common species in the family. It is a grass- and an herb-inhabiting insect, especially common in open grassy areas. It is also predaceous and adults have been reported as feeding upon eggs as well as nymphs and adults of other insects. Barber Point, Wanakena, Conifer, and Plains, June, July, August and September, 1917, 1919 and 1920.

Family MESOVELIIDAE

Mesovelia mulsanti White.

Common, collected at Bean Pond, Cranberry Lake, and other small ponds and lakes in the vicinity of camp. It prefers quiet waters containing an abundance of aquatic plants. Both apterous and macropterous forms were taken, the wingless individuals being the most numerous. Its life history and habits have been described by Hungerford (l. c., pp. 101-105).

Family NABIDAE

Pagasa fusca (Stein).

Barber Point, July and August, 1919.

Nabis subcoleoptratus Kirby.

June, July and August, 1917, 1919, and 1920, collected at Wanakena, Barber Point, Conifer and Plains. This predator occurs

mostly in the wingless forms and feeds largely upon the insects living on herbaceous plants. One alate individual was taken by the writer on some semiaquatic plants in the Plains.

Nabis limbatus Dahlbom (Fig. 27, a).

This insect is especially abundant upon rank vegetation growing in swamps, bogs and semiaquatic places. June, July, August and September at the Plains, Barber Point, Wanakena and Conifer.

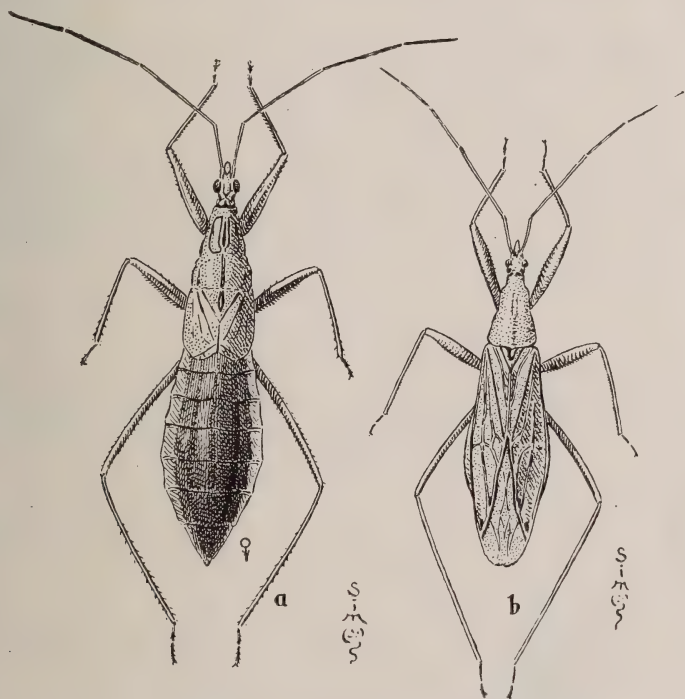


Fig. 27.—a, *Nabis limbatus* Dahl; b, *Nabis refuscus* Reuter.

Nabis ferus (Linnaeus).

Common, but never taken in large numbers like the preceding or two following species. This insect prefers open grassy areas and feeds largely upon grass-destroying insects. Osborn states that it is an important enemy of the Meadow Plant-bug, *Miris dolabrata*, in Maine. Barber Point, Wanakena and Plains, 1919 and 1920.

Nabis roseipennis Reuter.

Very common (long- and short-winged forms) at Barber Point, Plains, Conifer and Wanakena during June, July, August and September, 1917, 1919 and 1920. *Roseipennis* inhabits the deep woods, lumbered tracts, and "burns" but seems to prefer more

or less open areas along trails and tote-roads. It feeds almost entirely upon grass- and herb-inhabiting insects.

Nabis rufusculus Reuter (Fig. 27, b).

Barber Point, Conifer, Plains and Wanakena, summers of 1917, 1919 and 1920. This species, like the preceding, is very common (both long- and short-winged forms) in the vicinity of Cranberry Lake and lives in a great variety of habitats, but seems to be more at home in the somewhat open areas along the trails and tote-roads. Numerous specimens were also collected on huckleberry bushes in bogs at Barber Point and Wanakena. In the latter habitat it was also taken with *N. limbatus*. Eggs of *rufusculus* were observed in the stems of asters (*Aster macrophyllus*) on crest of Crataegus Hill, Barber Point, 1920, by the writer. These asters were badly infested by aphids, a tingid and a small mirid. *Rufusculus* and the other species of nabids listed above are preëminently wandering, grass- or herb- or very low shrub-inhabiting species and preys upon the insects found on these plants. They are rarely taken, and perhaps never breed, upon tall shrubs or trees.

Family MIRIDAE

Collaria meilleurii Provancher.

Very common, especially in small open areas upon rank vegetation. Barber Point, Wanakena, Plains and Conifer during the latter part of June, July, August and September.

Collaria oculata (Reuter).

Barber Point, Plains and Wanakena, taken in company with *C. meilleurii*, but not in such large numbers.

Miris dolobrata (Linnaeus).

Very abundant in open dry grassy areas, especially along the trails in the old burned over areas. Barber Point, Wanakena and Plains during June, July and August. The winter is spent in the egg stage and the young nymphs are often very numerous on grasses, especially timothy, in the forepart of June. The life history and habits of this insect, commonly called the "meadow plant-bug," has been published by Osborn in Journ. Agr. Research, Vol. XV, No. 3, pp. 172-201.

Stenodema trispinosum Reuter.

Barber Point, Wanakena, Plains and Conifer, June, July and August. At Barber Point this insect was quite common on tall grasses and weeds along the trails and in the Beaver meadow.

Stenodema vicinum (Provancher).

Barber Point, Wanakena, Plains and Conifer, collected in company with *S. trispinosum* and *T. ruficornis*.

Trigonotylus ruficornis (Geoffroy).

Several specimens, taken at Barber Point, Plains and Wanakena.

Trigonotylus pulcher Reuter.

Barber Point, July 20, 1917.

Teratocoris paludum Sahlberg.

This palaearctic species was collected by Osborn in the Grasse River Bog, near Conifer, July 22, 1920.

Platytyellus insitivus (Say).

Barber Point, July, 1920.

Platytyellus rubrovittatus (Stal).

Several specimens, taken during July and August in the Beaver Meadow and bog at Barber Point.

Platytyellus sp.

Barber Point, July 5 and 13, 1920.

Platytyellus nigricollis Reuter.

Barber Point and Conifer, July and August, 1920.

Neurocolpus nubilus Say.

Barber Point, July, 1920.

Mimoceps gracilis Uhler.

Sweeping weeds at Barber Point and the Plains in July.

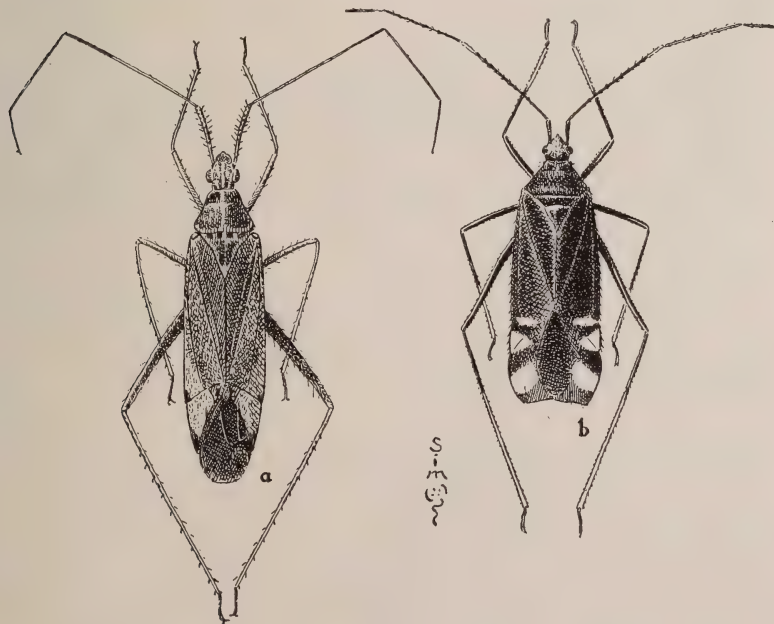


Fig. 28.—a, *Phytocoris lasiomerus* Reuter; b, *Macrotylus sexguttatus* Prov.

Phytocoris lasiomerus Reuter (Fig. 28, a).

Barber Point, Plains and Wanakena, July and August. Specimens were taken on *Salix* and also by sweeping weeds at Barber Point.

Phytocoris pallidicornis Reuter.

Barber Point, Plains and Wanakena.

Phytocoris cortitectus Knight.

A male, taken at Barber Point, July 20, 1921.

Phytocoris eximius Reuter.

Wanakena, August 12, 1920.

Phytocoris salicis Knight.

On *Salix*, Barber Point, August 12, 1920, and Wanakena, July 24; on yellow birch, in the burned over tract at Barber Point, July 24, 1920.

Phytocoris erectus Van Duzee.

Wanakena, August 12, 1920.

Phytocoris fulvus Knight.

Common on white pine during July and August at Barber Point and Wanakena.

Adelphocoris rapidus Say.

Very common on numerous herbaceous plants, especially in open areas. The insect is found throughout the greater part of the United States and Southern Canada, often becoming a rather serious pest upon a number of cultivated plants. Barber Point, Wanakena, Conifer and Plains during the entire summer. A female, taken at the Plains, August 25, has a black head like some of the western varieties.

Stenotus binotatus (Fabricius).

Several specimens, taken at Barber Point, Wanakena, Conifer and Plains, during July and August.

Garganus fusiformis (Say).

Barber Point, July and August, 1920-1921.

Poeciloscytus unifasciatus (Fabricius).

Barber Point and Wanakena, July, 1917 and 1920.

Poeciloscytus venaticus Uhler.

Very common along the trails and tote-roads in the burns at Barber Point and Wanakena during the entire summer.

Horcias dislocatus (Say).

Barber Point, July, 1920.

Horcias dislocatus affinis (Reuter).

Sweeping grasses and weeds at Wanakena, August 1-7, 1917, and Barber Point, August 12, 1920.

Horcias dislocatus limbatellus (Walker).

Taken along the old tote-road in the burned over track, Wanakena, August 1-7, 1917.

Peocilocapsus lineatus (Fabricius).

Common in open areas during the summers of 1917, 1919 and 1920. Barber Point, Wanakena and Plains. Specimens have been taken on the blossoms of wild *spiraea*, *Spiraea latifolia* Borkh. in the old burn, beaver meadow and cut-over areas at Barber Point.

Capsus ater (Linnaeus).

Very abundant on grasses and weeds in open places along the tote-roads and trails. Barber Point, Wanakena and Plains during the summers of 1917, 1919 and 1920.

Coccobaphes sanguinarius Uhler.

Several specimens, collected at Barber Point, Wanakena and Plains. Most of the specimens at Barber Point were found on striped maple and mountain ash.

Lygidea rubecula (Uhler).

Several examples, Barber Point, July and August, 1919 and 1920.

Lygidea rubecula obscura Reuter.

Many nymphs and adults on *Salix* spp. Barber Point, Wanakena, and Plains, July and August, 1917, 1919 and 1920.

Platylygus luridus (Reuter).

Barber Point and Wanakena during the later part of June, July and August. The insect was found breeding on white pine at Barber Point.

Lygus pratensis oblineatus Say.

Barber Point, Plains and Wanakena, 1917, 1918, 1920. This insect is very common and feeds on a great variety of plants.

Lygus vanduzeei Knight.

Very common, taken at Barber Point, Plains and Wanakena, 1917, 1919 and 1920. This species hibernates in the adult state and breeds largely on golden rod. Adults have been found feeding on the blossoms of *Spiraea* at Barber Point.

Lygus vanduzeei rubroclarus Knight.

Common at Barber Point, Plains and Wanakena during the summers of 1917, 1919 and 1920. This species is also common on the blossoms of *spiraea* and meadow rue. Adults have been taken on *Salix* spp. and golden rod.

Lygus plagiatus Uhler.

Sweeping weeds along the old tote-roads and trails at Barber Point and Wanakena during June, July and August.

Lygus pabulinus (Linnaeus).

Wanakena, Plains and Barber Point during June, July and August. The insect lives in cool moist places and Knight (l. c., p. 597) records the species breeding on touch-me-not, *Impatiens biflora*. The winter is spent in the adult state in Finland. Knight states that Crosby found a female hibernating beneath the bark of a tree in November in Cayuga county, and he also believes that it is quite probable that the species also passes the winter in the egg stage in the dried stems of the host plant.

Lygus approximatus Stal.

Wanakena and Barber Point, July and August, 1917. Knight took many adults on *Salidago macrophylla* near the summit of Whiteface Mountain, New York.

Lygus fagi Knight.

Breeds on yellow birch and beech. Barber Point, July and August, 1920. It prefers cool, shady locations and the eggs hatch in early spring. Adults were also found on maple at Barber Point.

Lygus atritylus Knight.

A very common insect on *Salix* spp. in moist, shady situations. Nymphs were very abundant on willow during May and early June and the adults and larger nymphs during the latter part of June, July and forepart of August. Barber Point and Wanakena, 1919 and 1920.

Lygus alni Knight.

Barber Point and Wanakena. Breeds on alder (*Alnus incana*), yellow birch (*Betula lutea*). Adults have also been swept from *Salix* spp. Winter is spent in the egg stage and adults are found during the latter part of June, July and August.

Lygus parshleyi Knight.

Barber Point, July 23, 1917.

Lygus communis Knight.

Barber Point, July and August, 1917.

Lygus belfragii Reuter.

Barber Point and Wanakena, July and August, 1917 and 1920, on mountain ash (*Acer spicatum*) and striped maple (*Acer pennsylvanicum*). Knight records the insect upon *viburnum acerifolium*, *Cornus alternifolia*, *Conium maculatum* and also *Acer spicatum*.

Lygus hirticulus Van Duzee (Fig. 29, b).

Breeds on beech and yellow birch. Common. Barber Point, Plains and Wanakena during June, July and August. The winter is passed in the egg stage and only young nymphs were observed

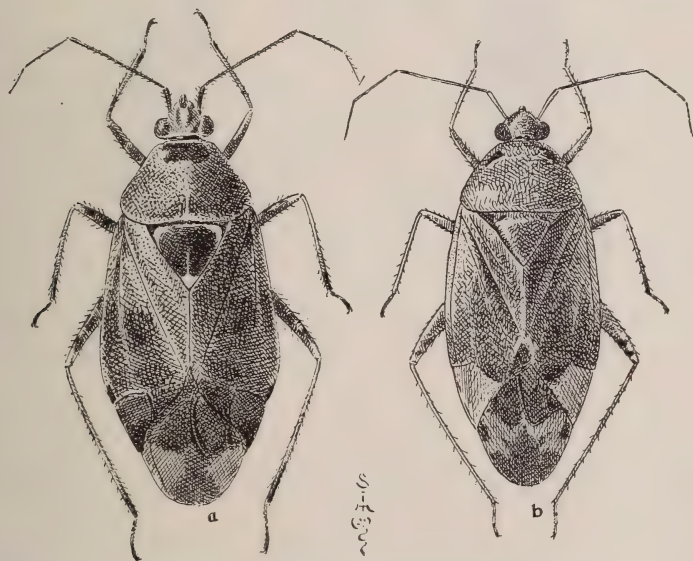


Fig. 29.—a, *Deraeocoris borealis* Van D.; b, *Lygus hirticulus* Van D.

in early spring. Knight records the species from chestnut, beech and woodbine in New York.

Lygus canadensis Knight.

Breeds on hazelnut, *Corylus rostrata* Ait., taken near the old "French Camps" at Wanakena, July and August, 1917 and 1920. This is the first record for New York State.

Lygus ostryae Knight.

On ironwood (*Ostrya virginiana*), Barber Point, July 5, 1920.

Neoborus amoenus (Reuter).

Barber Point, July, collected on white ash, *Fraxinus americana*.

Neoborus pubescens Knight (Fig. 30, a).

Very abundant on white ash seedlings and saplings in the vicinity of Crataegus Hill at Barber Point during June, July and August, 1919 and 1920. This insect lives in shady places and feeds almost entirely on the very young trees. It occurs in large numbers and the leaves are greatly discolored from feeding punctures. On the upper surface of the leaves the feeding marks show

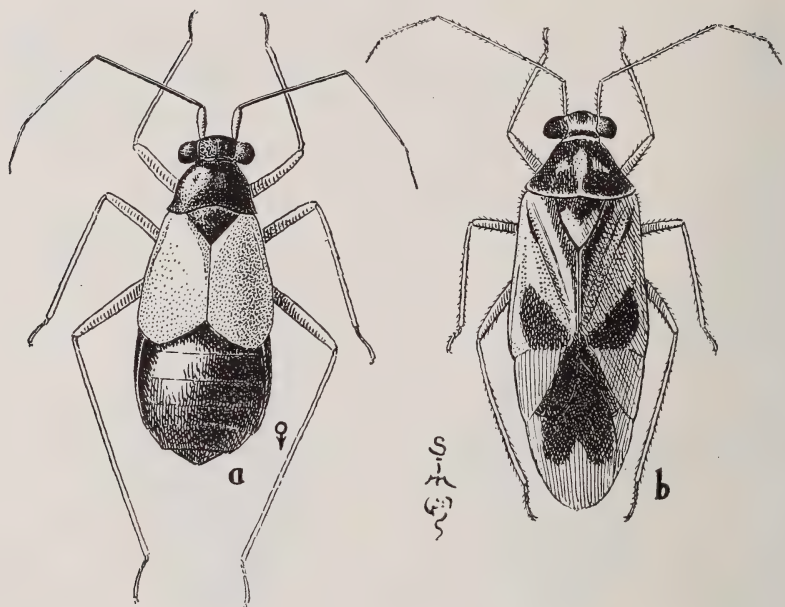


Fig. 30.—a, *Mecomma gilvipes* Stal; b, *Neoborus pubescens* Knight.

up as small, conspicuous whitish areas (frequently very many spots close together) and on the under side they are of a yellowish or brownish color and much less prominent.

***Deraeocoris nebulosus* (Uhler).**

Barber Point, July 19, 1920. Plains, July 25, 1920.

***Deraeocoris borealis* (Van Duzee) (Fig. 29, a).**

Several specimens, collected at Barber Point during July and August, on beech yellow and white birch, *Salix* pp., maple and alder. This insect is largely predaceous and feeds upon plant lice. It also sucks up the droppings of "honey dew" of the aphids. On yellow birch we found it living in the woolly aphid, colonies, that cause the curled or wrinkled leaves. Its color greatly resembles that of the woolly aphids during its nymphal instars. Osborn took an adult feeding on a large nymph of a cercopid, *Closliptera obtusa*, on yellow birch at Barber Point.

***Deraeocoris pinicola* Knight.**

Very common on white pine, *Pinus strobus*, at Barber Point, during June, July and August, 1919 and 1920. Specimens are also at hand from Conifer, Plains and Wanakena. The latter specimens were probably swept from larch and spruce.

***Deraeocoris laricicola* Knight.**

Taken on larch, Grasse River Bog, by Osborn.

***Deraeocoris fasciolus* Knight.**

Wanakena, July 1-7, 1917, Barber Point, July 26, 1920.

***Monalocoris filicis* (Linnaeus).**

Barber Point, Plains, and Wanakena, June, July and August, 1919 and 1920.

***Hyaliodes vitripennis* (Say).**

Several specimens. Barber Point, Wanakena and Plains during June, July and August. Adults were swept from yellow birch and beech at Barber Point.

***Dicyphus agilis* (Uhler).**

Sweeping ferns. Barber Point and Wanakena, July and August, 1917 and 1920.

***Dicyphus famelicus* Uhler.**

Barber Point, August 1, 1917.

***Dicyphus vestitus* Uhler.**

Sweeping ferns in shady places at Barber Point and Wanakena, July and August, 1917, 1919 and 1920. Specimens are also at hand from Conifer and Wanakena.

***Macrolophus separatus* (Uhler).**

One female, taken at Wanakena, July 15, 1920.

***Labops hirtus* Knight.**

Numerous short-winged and a few long-winged forms, taken on grasses and weeds at Barber Point, Wanakena, Plains and Conifer during June, July and August, 1917, 1919 and 1920.

***Strongylocoris stygicus* (Say).**

Many specimens swept from grasses and weeds in small open areas. Barber Point, Wanakena and Plains during June, July and August.

***Pilophorus amoenus* Uhler (Fig. 31, *a*, *b* and *c*).**

Collected on *Salix* spp., yellow birch, beech, maple, and white pine, also sweeping herbaceous plants. This is common during June, July and August and is probably predaceous.

***Ceratocapsus modestus* (Uhler).**

Wanakena, August 1-7, 1917.

***Ceratocapsus pumilis* (Uhler).**

Barber Point, Plains and Wanakena, July and August, 1917 and 1920. Specimens were swept from willow and grasses at Barber Point.



Fig. 31.—*Pilophorus amoenus* Uhler: a, adult; b and c, nymphs.

***Lopidea media* (Say).**

Very common. Barber Point, Wanakena, Plains and Conifer. Specimens were taken on *Salix*, maple, blossoms of *spiraea*, and also by sweeping various grasses and weeds at Barber Point.

***Diaphnidia pellucida* Uhler.**

On *Salix* spp., beech and yellow birch at Barber Point, July and August, 1917 and 1920. Breeding on hazelnut, *Corylus rostrata*. Wanakena, June, July and August, 1917, 1919 and 1920.

***Diaphnidia provancheri* (Borke).**

On beech and yellow birch. Barber Point, August, 1920.

***Diaphnidia capitata* Van Duzee.**

Beech and yellow birch. Barber Point, June and July, 1919 and 1920. Very common and breeds on hazelnut in company with *D. pellucida* at Wanakena during June, July and August, 1917, 1919 and 1920.

***Reuteria irrorata* (Say).**

Cranberry Lake, August, 1917.

***Orthotylus viridis* Van Duzee.**

Barber Point, July, 1920.

***Orthotylus translucens* Tucker?**

On yellow birch. Barber Point, July 24, 1920.

Orthotylus dorsalis (Provancher).

Common and breeds on *Salix* spp. Barber Point, Plains and Wanakena, July and August, 1917, 1919 and 1920.

Orthotylus catulus Van Duzee.

Wanakena, August 1-7, 1917.

Ilacora malina (Uhler).

Barber Point, Wanakena and Plains. Very common during the summers of 1917, 1919 and 1920.

Mecomma gilvipes (Stal) (Fig. 30, *a*, female).

Common in somewhat shaded, moist areas upon rank vegetation. Barber Point, Wanakena and Plains during June, July and August.

Macrotylus sexguttatus (Provancher) (Fig. 28, *b*).

Barber Point, Wanakena and Plains during June, July and August. The insect was found breeding on aster, *Aster acuminatus*, at Barber Point, during July and August, 1920.

Lopus decolor (Fallen).

Common. Barber Point, Wanakena, Conifer, and Plains during July and August.

Psallus n. sp.

Several specimens, taken at Wanakena, Plains and Barber Point during July and August, 1920.

Rhinocapsus vanduzeei Uhler.

Very common on rank vegetation along the trails at Barber Point, Wanakena and Plains during June, July and August.

Plagiognathus politus Uhler.

Barber Point, Plains and Wanakena during July and August.

Plagiognathus annulatus Uhler.

Barber Point during July and August, 1920.

Plagiognathus fuscus Provancher.

On yellow birch. Barber Point, August, 1920.

Plagiognathus chrysanthemi (Wolff).

Several specimens, taken while sweeping weeds in the old burn near the Ranger School, Wanakena, July 15, 1920.

Plagiognathus fraternus Uhler.

Conifer, Barber Point and Wanakena during July and August, 1920.

Plagiognathus sp. I.

Wanakena and Barber Point, July, 1920.

Plagiognathus sp. II.

Wanakena and Barber Point, July and August.

Plagiognathus sp. III.

Wanakena and Barber Point, July. Knight will discuss this species and the two forms above when he publishes on the genus *Plagiognathus*.

Chlamydatus pulicarius (Fallen).

Barber Point, August, 1919.

Family GERRIDAE**Gerris remigis** Say.

Common, only apterous forms being seen or captured. This insect lives in the coves of Cranberry Lake, Oswegatchie River, and it often congregates in large numbers in pools or slow-moving parts of streams. It spends the winter in the mature state.

Gerris marginatus Say.

Common. Taken on Cranberry Lake, Oswegatchie River and Bean Pond. This species is a lacustrine and fluviatile insect, but seems to prefer quiet waters.

Gerris argenticollis Parshley.

Taken in the coves of Cranberry Lake with *marginatus* and *buenoi*.

Gerris buenoi Kirkaldy.

This is by far the most abundant species of the smaller forms of the genus living in the vicinity of Cranberry Lake. Its habits and haunts are quite similar to that of *G. marginatus*.

Gerris rufoscutellatus (Latreille).

Very common. Barber Point, Wanakent, Plains, and Conifer. This insect hibernates over winter in the mature form and is among the first of the water-striders to appear in early spring. The eggs are deposited just beneath the surface film of the water upon floating leaves of aquatic plants, small sticks and other objects in the water. They hatch in about ten days or two weeks. In an aquarium the first adults appeared thirty-four days from the time of hatching, but most of the specimens required several days longer to reach the adult state. Like the other members of the genus *rufoscutellatus* is predaceous and feeds upon small insects, and insects that happen to fall in the water and are drowned. Field observations indicate two generations a year in the Adirondacks.

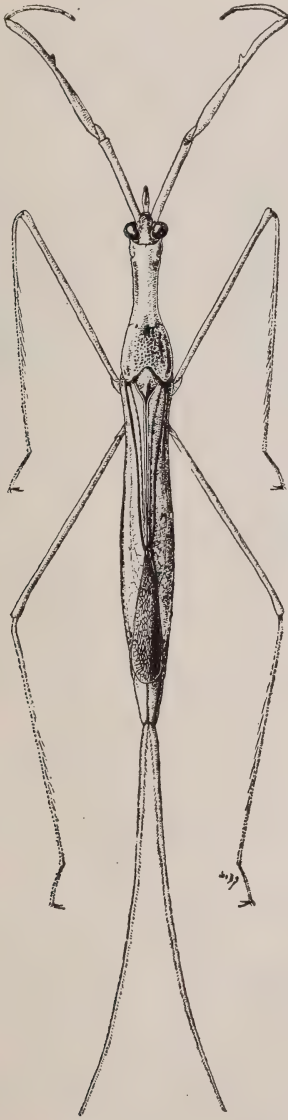


Fig. 32.—*Ranatra americana* Mont. Drawn by J. D. Smith.

***Metrobates hesperius* Uhler.**

Very common on Cranberry Lake and the Oswegatchie River. Only the apterous form was observed. It is usually taken in company with the two following species.

Trepobates pictus (Herrich-Schäffer).

This species and *Rheumatobates rileyi* congregate by the thousands upon Cranberry Lake and Oswegatchie River. It is very variable in color and size, and occurs almost entirely in the apterous form. One deâlated specimen is at hand.

Rheumatobates rileyi Bergroth.

This insect is represented by many color variations, but there does not seem to be any distinct color variety.

Family VELIIDAE**Microvelia borealis** Bueno.

Several specimens, taken at Barber Point.

Microvelia buenoi Drake.

Common, collected in Bean Pond (type locality) and in the beaver meadow at Barber Point. It lives near the shore in quiet waters.

Microvelia americana Uhler.

This species is not very common and lives near the shore of streams, lakes and ponds. Barber Point, Plains and Wanakena.

Rhagovelia obesa Uhler.

Occurs in the eddies of Sucker Brook at Barber Point.

Family SALDIDAE**Pentacora ligata** (Say).

Common on stones jutting out of the water in Sucker Brook in open sunny places at Barber Point.

Salda coriacea Uhler.

Proulx's Camp near Barber Point, July 22, 1920.

Saldula major (Provancher).

Very common along small streams near Proulx's Camp.

Saldula confluenta (Say) (Fig. 33, a).

Taken on a floating log near Barber Point and along a small stream at Proulx's Camp.

Saldula orbiculata (Uhler).

Several specimens, taken along a small stream near Proulx's Camp. I have also taken this insect on small ponds upon floating aquatic plants several feet from the shore.

Saldula interstitialis (Say).

Very common at Barber Point, Wanakena and Proulx's Camp.

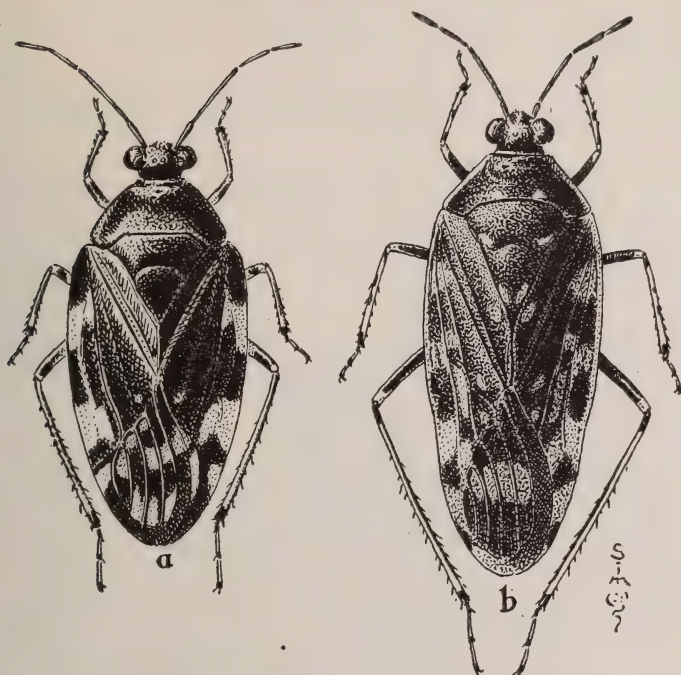


Fig. 33.—a, *Saldula confluenta* Say; b, *Pentacora ligata* (Say).

***Saldula pallipes* (Fabricius).**

Common, collected along the shore of Cranberry Lake, Bean Pond and Proulx's Camp.

***Saldula separata* (Uhler).**

Common along a small stream in the vicinity of Proulx's Camp.

***Saldula reperta* (Uhler).**

Taken along a small stream in the vicinity of Proulx's Camp.

***Micranthia humilis* (Say).**

Common near the shore of Cranberry Lake, Wanakena and Proulx's Camp. The small stream in the cut-over trakt in the vicinity of Proulx's Camp offer the most favorable haunts and breeding places for the Saldidae. There are numerous small open sunny and somewhat moist places and many semiaquatic Diptera and other insects that furnish an abundant food supply. In fact there were many specimens of the Saldidae, both nymphs and adults, living near this small stream.

Family NOTONECTIDAE***Notonecta undulata* Say.**

Very common, taken in a stagnant pool formed by floating logs at Barber Point and Bean Pond during July, 1917, 1919 and 1920.

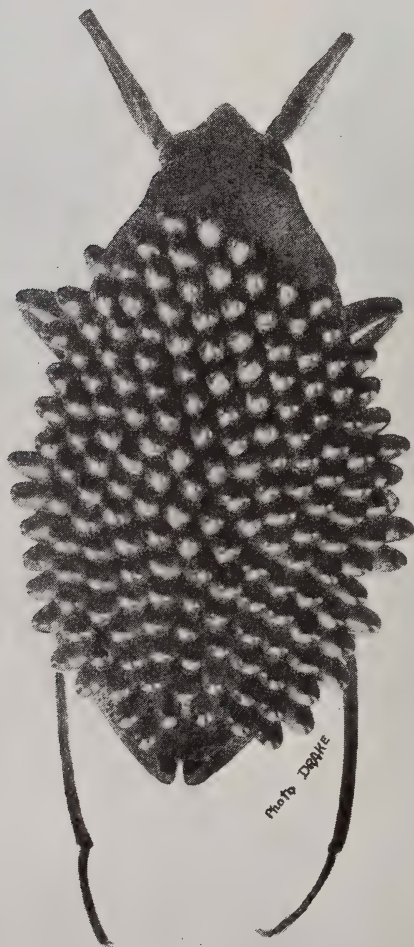


Fig. 34.—*Belostoma flumineum* Say. Male bearing eggs much enlarged. Photo by Drake.

Notonecta variabilis Fieber.

Bean Pond and Beaver Meadow, July and August.

Notonecta insulata Kirby.

Two examples from Bean Pond, July, 1919.

Buenoa margaritacea Bueno.

Many specimens from Bean Pond, 1917, 1918, 1919 and 1920.

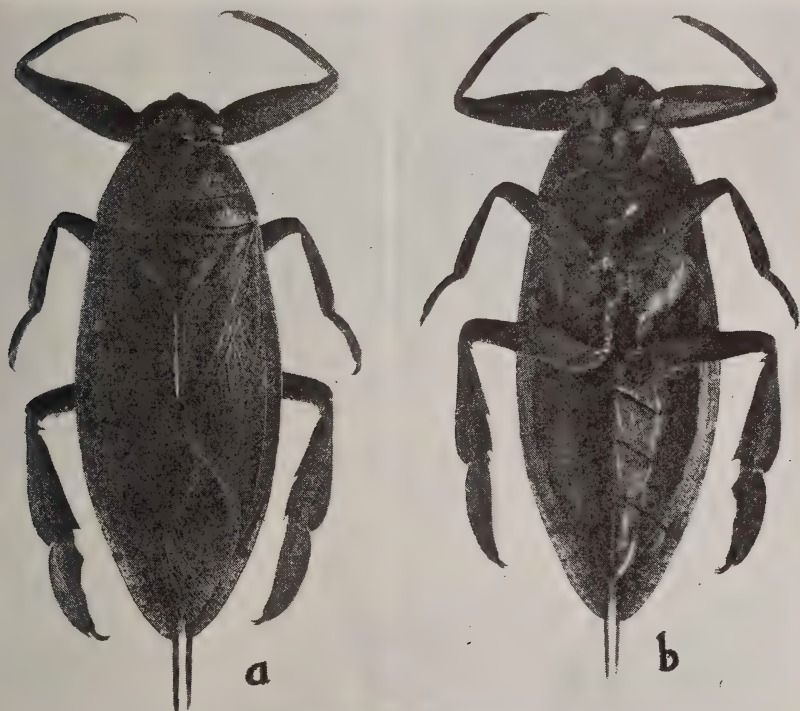


Fig. 35.— *Benacus griseus* (Say): a, dorsal view; b, ventral view. Photo by Drake.

Family NEPIDAE

Ranatra americana Montadon (Fig. 32).

Nymphs and adults, collected during July in Bean Pond and coves of Cranberry Lake. In Cranberry Lake the specimens were taken near the shore among a lot of small sticks and other debris.

Family BELOSTOMIDAE

Benacus griseus (Say) (Fig. 35).

Not common, collected in Bean Pond and coves of Cranberry Lake near Barber Point.

Belostoma fluminea Say (Fig. 34, male and eggs).

Bean Pond and Cranberry Lake near Barber Point. A specimen from Columbus, Ohio, is photographed.



Fig. 36.— *Belostoma fluminea*: a, dorsal view; b, ventral view.

Family CORIXIDAE

Callicorixa praeusta (Fieber).

A long series from Bean Pond, Beaver Meadow and coves of Cranberry Lake.

Palmacorixa buenoi Abbott.

Cranberry Lake near Barber Point.

Artocorixa scabara Abbott.

Two specimens from Bean Pond, Wanakena.

Arctocorixa compressa Abbott.

Taken in Cranberry Lake near Barber Point.

LIFE HISTORY NOTES ON CRANBERRY LAKE HOMOPTERA

BY HERBERT OSBORN

In connection with studies of the ecology of the Homoptera of the Cranberry Lake region it was possible to secure a number of records on the development of some of the species and, while these do not cover as long a period of the year as would be desirable for all purposes, the fact that for many species the summer months include the main events in the life cycle seems to warrant the publication of the records even if less complete than would be desired. From the author's standpoint this appears the more desirable because there is little probability that circumstances will permit him to work at periods necessary to complete the annual life cycles and the facts given here may serve as a basis to facilitate further studies. Also it is believed that the facts gained may serve for such appreciation of the injurious phases of the insect as to encourage working out practical measures for control. In some instances, if not all, the determination of certain fragments of the life history appears to supply a biological basis for the development of preventive or remedial measures which may be of service in the protection or conservation of the forest resources.

BIRCH TREE-HOPPER

Carynota stupida Walker

This species (Plate III) often occurs in large numbers on yellow birch, but its presence would scarcely be suspected since the insect is so perfectly protected by form and color that it is hardly possible to see them even when their position has been noted.

The nymphs occur almost invariably in the axils of small twigs, mostly on branches of one year's growth, the head pressed closely against the base of the twig, the body lying flat and lengthwise on the branch, the tail usually toward the tip of the branch (Fig. *k*, Plate III). Here they remain apparently immovable for long periods of time, the food supply being drawn doubtless from the cambium of the growing twig. They are very commonly attended by ants, so far as observed all of one species (*Formica sanguinea* Latr. sub. sp. *rubicunda* Emery*); and by far the easiest way to locate the nymphs is to look for the ants and note the nymphs which they are attending. The nymphs appear absolutely oblivious to the movements of the ants, although the frequent rubbing and "caressing" which they receive would seem to be sufficient to disturb them. The nymphs, however, appear to be very difficult to disturb, seeming to be glued to the twig, and only

* Identified by Dr. M. W. Wheeler, Harvard University.

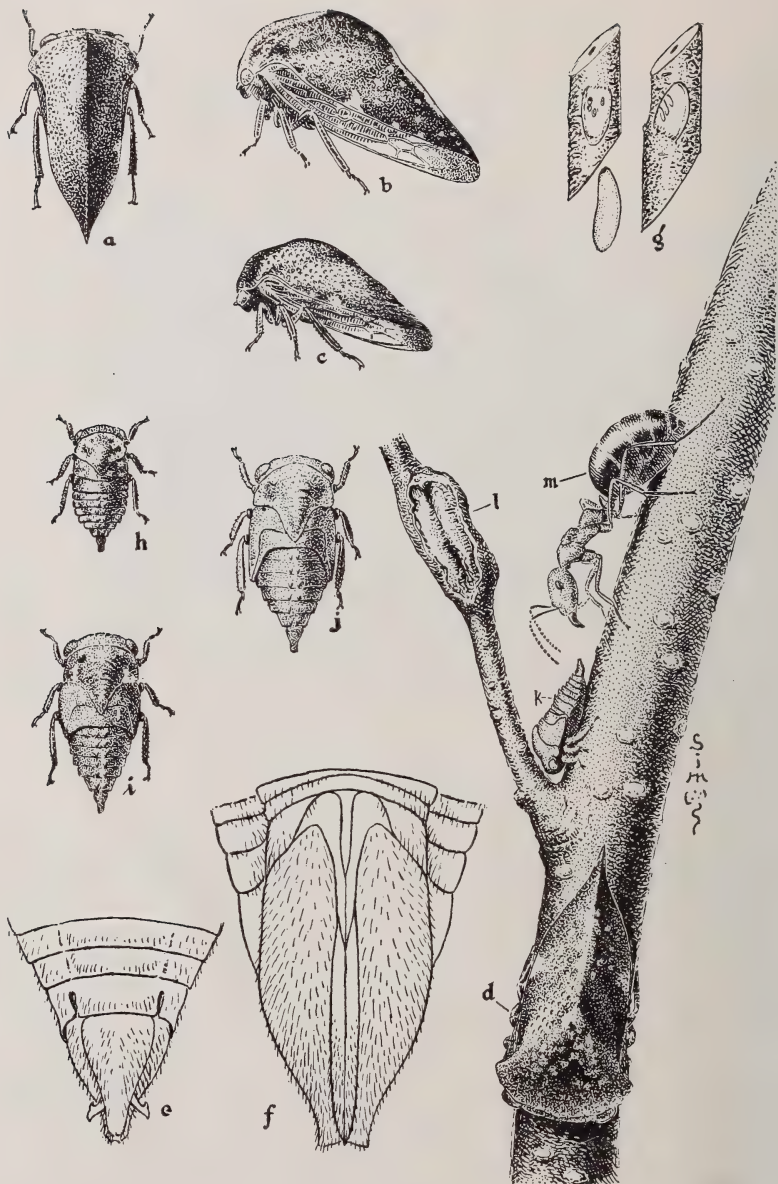


PLATE III

Birch Tree-hopper, *Carynota stupida* Walk.

- a, dorsal view of adult.
- b, lateral view of adult.
- c, female.
- d, adult on twig.
- e, male genitalia.
- f, female genitalia.
- g, egg puncture scars showing eggs and an egg greatly enlarged.
- h, i and j, nymphal stages.
- k, nymph feeding upon twig.
- l, scar on twig resulting from egg deposition.

forceful action will ordinarily dislodge them. The adults are almost equally difficult to move (possibly the basis for Walker's name *stupidus*), no doubt having become fully adapted to dependence on their protective features to escape enemies. The human enemy is, of course, an entirely negligible factor in the immense solitudes of the great birch forests and especially in the tree tops, but the prying eyes of insectivorous birds may well be deceived by the perfection of the resemblance displayed.

The attraction for the ants lies in the liquid discharge from the anus, no doubt comparable to the "honey dew" of aphids, and the constancy of the association would indicate that the ants make a large use of this food supply during the period of life of the tree-hoppers. When aphids are also present the same ants appear to visit either aphid or tree-hopper.

The species was first described by Walker from specimens received from Canada (?) but with no description of early stages. Later descriptions by Butler, Provancher and Goding, none of

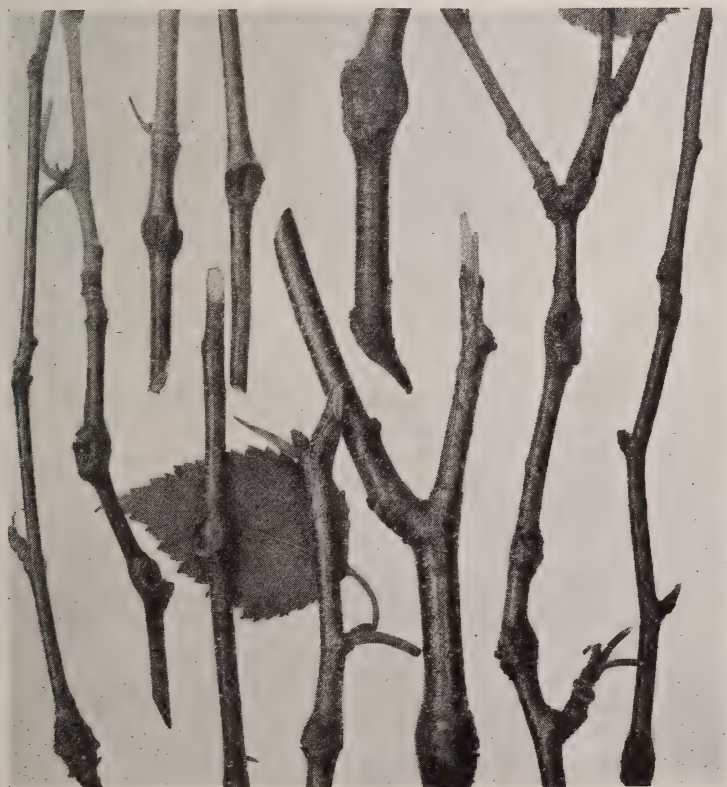


Fig. 37.— Yellow birch twigs showing egg-punctures (two, three and four years old) of *Carynota stupida* Walk. Photo by Fivaz.

which go into details of the life history or habits, have evidently been based on limited material appearing in collections.

It is not at all strange that specimens have been rare since the species is adapted to life in a manner which precludes its frequent collection. In the primitive forest or on all larger trees the insect occurs probably only on the outer part of branches in the upper part of the tree, or at least far from easy capture by the entomologist. Only the fortunate occurrence of numerous young yellow birch trees in a cut-over and burned tract at the State Forest Camp has furnished the opportunity to note the mode of life and stages of growth which apparently have escaped the attention of entomologists up to the present.

LIFE HISTORY

While field observations have been limited to the summer months and we are, of course, without ocular evidence concerning conditions during the winter months, the fact that the active part of its life cycle is practically completed between June 1 and September 1 makes it possible to detail the life cycle with entire confidence. The remainder of the year from egg deposition in late summer till egg hatching in late May must be passed in the egg stage within the twigs of birch. The earliest date of egg hatching is not known, but Dr. Drake has observed very young nymphs, evidently first instars, as early as May 30 and nymphs of third or fourth instar are found by July 1. The earliest adult female noted in 1920 was July 13 and the first male July 16. So we may conclude that the period of development from egg to adult is close to six or seven weeks. The rate of growth is not entirely uniform or else the eggs of different clusters hatch at different times as nymphs of many sizes and different instars have been noted during the first two weeks of July with stragglers as late as the first week in August and adults have been emerging from July 13 to as late as the 29th. Adult females appeared July 16, but mating activity was not noted until July 23.

Emergence of adults from nymph case appears to come in the early morning, such emergence being noted from the 17th to the 19th and between eight and ten. One individual, a male, which was followed most closely, had split the nymph case along the dorsal line of head and prothorax when observed at a little before eight o'clock in the morning. It was attached to the underside of the petiole of a leaf with the head toward the tip of the leaf and in a position with reference to the twig which would place it nearly head downward, attachment to petiole being entirely by the tarsi of the nymphal case. The head, pronotum and base of abdomen were exposed, as also the forelegs, and the wings were out but scarcely longer than the wing pads, their tips being folded under. The pronotum was no longer than in the last instar nymph and did not expand until after expansion of the wings. In this condition the insect remained fairly quiet for a time, as if resting

after the initial effort of exclusion. The color at this period was pinkish, wings and pronotum first appearing colorless, with expansion later darkening to normal dark brown color. At nearly 7:55 the insect became active, grasping the petiole with its forelegs and the nymph case with hind feet, withdrawing the abdomen from the case and turning at right angles to the deserted skin. Meanwhile the elytra and wings were expanding rapidly enlarging at base to full width and unrolling toward tip, the extreme tip being the last to lose its pink color and to acquire the natural symmetry of the adult elytron. At eight the elytra and wings were fully expanded and the pronotal expansion started and five minutes later the wings were fully out in nearly natural position and the pronotum partially expanded at base and tip, with a distinct constriction near the tip. At 8:08 faint indication on spots on head and base of pronotum could be seen, the coloration lying toward the head end but the elytra at this time was entirely transparent. At 8:10 the pronotum was nearly expanded, the base and tip nearly normal, but deeply hollowed at the middle and the tip reaching only to the tip of the abdomen, the following two minutes marking the beginning of coloration of the base of the elytra, the further extension of pronotum which is still constricted somewhat midway and nearly colorless. At 8:15 the constriction of the pronotum was nearly gone and a minute later entirely so, the structure reaching its mature form and reaching nearly to the tip of the elytra. At this time the elytra nearly covered the wings, the latter at first drooping below, the elytra gradually drawing up closer to the body and assuming the normal position at rest. At 8:20 the coloring became more noticeable, the costa darkening and the pronotum becoming a pinkish red, the eyes dark red and all traces of the pronotal constriction are gone and thus the insect is fully normal except in color; and at 8:22 it walked about quite actively with apparently very free use of the legs which a few minutes earlier were flabby, helpless structures. The head has become bluish white; the further change noted in this specimen concerned simply the color, which at about 10 had become dark brown, the nearly normal hue for average specimens.

The first indication of mating was July 23, on a tree in the open with the male clinging to the back of the female but not on center; July 29, male and female were on same twig end to end, but no evident copulation; August 31, many males noted resting on females but none were seen in coition. The prenuptial attentions are apparently quite extended and the males rest uniformly on the side of the pronotum of the female, the feet of one side closed beneath the border of the elytra of the female. Often two males are seen attached to one female but seemingly oblivious of each other. They have no attachment to the twig and the female walks readily up or down the twig. As they are almost invariably accompanied by one or more attendant ants, the moving mass presents a very grotesque appearance. In some instances three

and even four males were seen attached to or clustered around a single female.

Actual egg deposition was not observed but newly laid egg masses, which must quite certainly be connected with this species, were found in twigs sent to me from Cranberry Lake after my return to Columbus. These are laid in two masses diverging from a central line and with the ends of the eggs scarcely below the level of the bark. The position of the egg masses is indicated in the figure (Pl. III, fig. g).

Unquestionably the eggs must remain in the twigs over winter for hatching in spring or early summer.

The smallest nymph observed was 3 mm. in length, with the head very short as seen from above; the pronotum was somewhat curved forward between the eyes; the anterior part depressed and the posterior part elevated. The crest was slightly elevated, much less so than later. The apex half way upon the mesonotum; the mesonotum of equal length, forming about a half cylinder. There are no wing pads but the hind quarter of the mesonotum is slightly produced at lateral border. The abdomen is short, roundly narrowed to terminal segment, which is cylindric, about one-half longer than thick. The legs when contracted do not show from above; the tibia flattened and in natural position at rest are scarcely visible.

The largest nymph is 7.5 mm. long and about one-half as wide; brown-gray, mottled distinctly with white. The head is scarcely visible from above and with the eyes is as wide or a trifle wider than the pronotum. The pronotum is elevated, the central portion rugose, the posterior border produced into an acute process extending over to the meso- and on to the base of the metanotum. The mesonotal wing pads reach the second abdominal segment and overlap the metanotal wing pads which reach about the same point, the hinder border paralleling the mesonotal pads. The abdominal segments 2-7 have a pair of short depressed spurs near the middle line and close to the hind edge. Beneath it is distinctly flattened and the venter is greenish.

The deposition of eggs in the twigs or small branches, mostly in the cambium, results in a distorted growth, the character of which is quite evident from comparison of scars of different ages (Fig. 37) measured by the age of twig or branch. Eggs are mainly, if not entirely, deposited in twigs of the previous year's growth and the result of the first year's growth of new tissue is a deep fissure with protruding lips on the side, the central strip of bark apparently having dried up and broken away. Another year's growth fills in the fissure and still further enlarges the bulb-like swelling of the twig and later years add thickness to the swelling with the growing branch, perhaps ultimately obliterating the scar entirely but in some instances quite evidently causing a weakened spot that may result in the breaking of the branch.

The economic importance of these insects is dependent upon the abundance in which they occur, and from the amount of damage done to a number of the trees at the Summer Camp it is evident that in abundance they will cause very considerable injury. The damage is of two kinds:

The first, that resulting from the sucking of the sap from the trees by the nymphs, a result which may be quite severe, especially if the nymphs occur as has been observed, by several hundred on a single small tree.

The second kind of damage is that due to punctures made by the females in depositing eggs and this damage, as indicated above, depends largely upon the size of the branch or twig which is attacked.

NATURAL ENEMIES

We have not observed any natural enemies that could be considered of any special value in reducing the numbers of the insects. The ants, which are constantly in attendance upon the tree-hoppers, are unquestionably seeking the secretion which they use as food and, if having no other relation to the hopper, must be of service to them in keeping other insects away. We have observed no birds feeding upon the insects nor have we found hoppers in the webs of spiders. One female was found with the contents of the abdomen eaten out, but it had the appearance of having been attacked by some species of fungus. However, no general attack of this kind has been observed and it seems evident that the natural enemies are of little account in the matter of control.

It is difficult to suggest any control measures which could be thought of as of service in any large way as applied to the forests, but for individual trees under observation it would be a simple matter to trim the twigs containing egg punctures during the fall, winter or early spring, although the newly formed punctures are too inconspicuous to be found without some careful examination. From the evident inclination of the females to cling closely to the trees on which they develop it would seem quite possible to beat them from small trees but in that case they would no doubt seek other trees in the same locality, and the plan cannot be recommended as of any value except for individual small trees in parks or private grounds.

ASPEN TELAMONA

Telamona barbata Van Duzee

This *Telamona* is a fairly common species on aspen, but less abundant than the birch tree-hopper. Nymphs were taken July 3 and adults (males and females) first noted July 19th. While not agreeing in all details this seems best placed in *barbata*, though resembling *reclivata*, which according to Funkhouser occurs on basswood. In this form the crest of pronotum has a short elevation at apex of crest, drops a little and runs in straight descending

line to posterior concavity, while *reclivata* is figued as straight, from tip to concavity.

Twig scars, which from association are quite certainly to be referred to this species, show two adjacent curved scars of the usual membracid type. Previous years' punctures on one or two year old twigs are uniform, almost circular, with the surface of healed part deeply blackened and with a narrow fissure at center. Older deformities show much swelling and distortion. A group of these scarred and deformed twigs or branches all apparently to be referred to this species are shown in Fig. 15, photographed by Fivaz from twigs collected at the Forest Camp.

Aspen is of too little commercial value to make this an important species and unless it is found to attack other forest trees of the locality it may be considered for this particular region as of little consequence. With other trees involved or with commercial use of the aspen wood the species would at once assume economic importance.

WILLOW LEAF-HOPPER

Idiocerus suturalis Fitch

This insect was frequently observed on willows near the camp site, Barber Point, during the summer. Immature forms, collected on willow and reared in the insectary, emerged as adults July 12. The species also occurred in considerable numbers on aspen (camp site) during the first week of July and for several days later. The nymphs, mostly of the final instar, present considerable variation in markings, usually showing from two to four black spots on the margin of the vertex between the eyes, the inner ones round or slightly angular, the outer ones near the eye elongate—triangular or squarish. In some individuals, otherwise apparently identical, there were two rows of quadrate black dots running the length of the body.

The nymphs live on the leaves, move about quite actively, occasionally jumping if disturbed. The leaves show numerous blackened or browned spots which are apparently due to the feeding punctures. A few badly infested leaves were entirely brown.

ASPEN LEAF-HOPPER

Idiocerus lachrymalis Fitch

Adults and nymphs (Fig. 38) were collected on aspen July 2, 1920, the latter with head markings resembling mature forms with two large black spots, borders next eye, two small round spots near hind border and spots in hind border, two large transverse spots on pronotum, a large black spot rounded behind, divided by narrow line, on mesothorax; base of metathorax between wing pads black; margin of abdomen dark, leaving ovate central disk greenish; below black margined, disk of abdomen greenish, segments five to seven black.

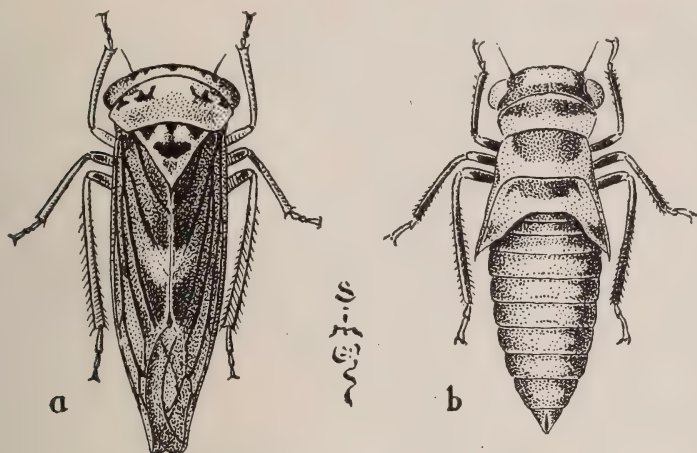


Fig. 38.—*Idiocerus lachrymalis* Fh: a, adult female; b, nymph.

Specimens of last instars were caged on July 2 and issued as adult during the night of July 4th or the morning of July 5th. (See Fig. 38.)

SCARLET LEAF-HOPPER OF PINE

Empoasca coccinea (Fitch)*

In the very brief description given by Fitch which reads "Scarlet Empoa, *E. coccinea*. Scarlet red, immaculate, pectus and venter orange, elytra brownish-pellucid. Length 0.10. Taken on pines No. 829, male." there is no mention of economic importance nor hint as to the abundance of the species. Since Fitch's time it would seem that the species has been very rarely taken so that it is a matter of some interest to find the species occurring in great numbers on white pines in the Cranberry Lake region. As both adults and nymphs have been secured from this host plant and nymphs from no other it is safe to conclude that it has close restriction to the white pine or at most may occur on closely related species. Collections of the adults were made by Drake in 1917 and during the present season we have taken them in large numbers both by beating and sweeping, especially in late July, at which time the nymphs were noted in greatest numbers.

The nymphs which were mainly in the last instar have the general appearance of the *Empoasca* nymphs are dark green in color closely resembling the pine leaves in tint and have a length of 2.75 mm. to 3 mm. The head is short, broad, subtruncate in front, the vertex depressed with two oblique furrows forming a

*The species is included in Gillette's monograph under the genus *Typhlocyba* and he copies Fitch's description and states that he had not seen specimens and did not know of a determined specimen in existence.

broad V. The wing pads extend to the third abdominal segment and are paler than the body, the scutellum is tinged with yellow and the abdominal segments 1-5 are bordered on the hind margins with brownish. The coxae and base of the abdomen beneath are tinged with blue.

KENNICOTT'S LEAF-HOPPER

Thamnotettix kennicotti Uhler

The nymphs of this species (Fig. 39) were taken frequently during July and early August usually from sweeping hard maple undergrowth or seedlings, and the first adult observed for the season emerged from a nymph in cage August 8.

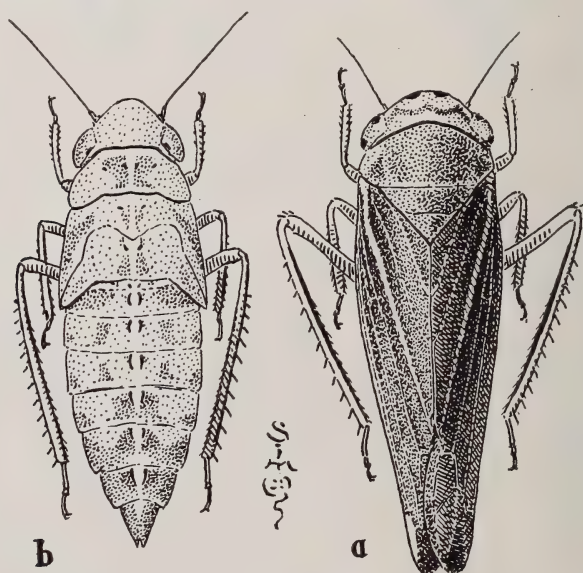


Fig. 39.—*Thamnotettix kennicotti* Uhl: a, adult female; b, last last instar nymph.

The nymphs were supposed at first to be *Mesamia vitellina*, adults of this species occurring frequently in the same association. Moreover, these nymphs agree very closely with Ball's brief description of the nymph of *M. vitellina*.

Nymphs in confinement survived well on leaves of maple, feeding perhaps most frequently from the petiole, one specimen being kept alive from July 19 to August 8 with occasional supply of fresh leaves.

The nymph of the last instar is about 4 mm. long. The head is distinctly angular and nearly at right angles with front, somewhat flattened and without depressed areas—a little longer than the prothorax and the angle to the front obtuse. The wing pads reach

to the second abdominal segment and are wider than the abdomen. The abdomen narrows from the second segment and in full fed individuals is quite long, tapering gradually to the rather acute tip.

The color is white or yellowish white, minutely dotted with brown or blackish in a definite pattern for the abdomen but with rather scattered spots on the thorax. There are lateral patches on the pronotum, a median patch on the line opening on the mesothorax and meta-thorax and converging stripes on the abdomen starting from the sides at the base and meeting on the third segment continuing as median stripes to the sixth, which is entirely dark. The seventh segment is paler than the sixth and the apex with bristles. The body beneath is all white, the cheeks are partially dotted with blackish, the legs are entirely white. The beak extends to the second pair of coxae.

SLOSSON'S ELIDIPTERA

Elidiptera slossoni Van Duzee

This species (Fig. 40) presents some very interesting features and furnishes a hint as to the habits and life history of other members of the genus which should make it possible to add much of interest in their study.

Hitherto the genus has been represented quite sparingly in collections and so far as known to the writer nothing has been published as to their life history or habitats.

In 1917 a number of adults and nymphs were taken by Professor Drake and sent to me for identification. Additional specimens have been secured the past season and the data now

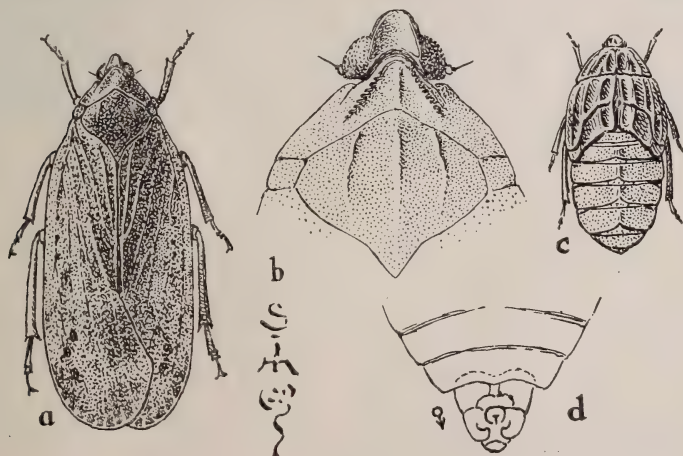


Fig. 40.—*Elidiptera slossoni* Van D.: a, adult; b, head, pronotum and scutellum dorsal view — much enlarged; c, male genitalia; d, nymph of last instar.

available warrants a record of parts of the observed cycle and quite certain inferences as to other phases.

The adults (Fig. 40) appear in July or early August (one taken July 19, 1920, by Mr. Fivaz) and evidently while recently emerged are found in crevices of rotten wood or under bark of spruce stumps. At time of mating they probably take wing and the females no doubt seek out new and favorable dead trees for egg deposition. Drake reports that a number of the nymphs and adults were found in a spruce stub, 18 or 20 feet high and about 10 inches in diameter, and which had been dead several years. The eggs must certainly be laid on or under the bark, doubtless on trees or stumps in process of decay and where the nymphs develop.

The nymphs occur in the soft decaying tissue of dead trees between bark and wood or in crevices of rotten wood. Their food is presumably derived from the juices of the decaying wood tissue or fungi and this probably at a favorable stage of decomposition during the second, third or fourth year after the cutting of a tree or under natural conditions during the same period after death or injury of a tree from accident or natural causes. Many large nymphs and adults have been taken in quite rotten pine and spruce, Barber Point, 1917.

The nymph shown in the figure (Fig. 40), the only stage yet found, was taken in early August along with fresh adults and reared individuals show that nymphs mature and adults emerge about August 1.

The nymphs show the head characters of the adult with the vertex proportionately a little wider, slightly wider than long; the pronotal carinae are prominent, the median one disappearing anteriorly; the inner ones curved outward behind, and the lateral ones nearly paralleling the margin. On the mesonotum the five carinae diverge slightly from before backward and the median one is forked posteriorly. The metanotum has three carinae within the bases of the wing pads, corresponding with primary venation. The abdomen is nearly as wide at base as the thorax, broadly ovate behind the segments rather short, six segments being visible.

The body is decidedly flattened, similar to many other insects living under bark. The color is gray-brown with a darker median stripe and border. Length, 5 mm.; width, 2.4 mm.

It may be noted that all recorded American species of the genus are from localities where conifers are found and association with this food supply seems possible. It seems reasonable to expect, therefore, that many other species will be found to have a similar habit, perhaps associated with particular species of *Coniferae* such as larch, fir, southern pine, cedar, etc., and special attention to collecting where such opportunity presents may result in some interesting material and a great enrichment of collections. Aside from the biologic or ecologic interest attached to the species, there

is perhaps little of importance to the species as there is no evidence that it can cause injury to growing trees and the effect of its feeding upon the decaying tissue of fallen timber is entirely negligible.

PINE CHERMES

Chermes pinicorticis Fitch

Many years ago Dr. Fitch recognized this species (Fig. 42) as injurious to pine and indicated its potential possibilities as a forest pest. Since the time of his publication the species has shown itself at many localities and frequent intervals to be capable of serious



Fig. 41.—Pine blight (*Chermes pinicorticis* Fh.) showing aphids clustered on twig. Photo by Fivaz.

injury to pine trees and it deserved attention in any discussion of insects connected with forest problems. The species was observed on a number of small trees in the vicinity of the summer camp and in some instances in sufficient numbers to be counted injurious. If in large numbers on older and larger trees they were too far from observation to be recognized. In nurseries at the Ranger School it is frequently a very serious pest.

The infested trees are readily recognized by the appearance of numerous small flecks of white cottony material covering the bodies of the insects and adhering to the bark especially around the bases of the branches or in the axil of the twigs. They do not occur on the leaves but the twigs, branches and even the trunk

may be thickly dotted with little thin white tufts. The white cottony secretion consists of wax filaments secreted from glands on the upper surface of the abdomen and may be readily separated from the insect by touching with a needle or brush or dissolved away by application of creosote.

Since the description by Fitch the species has been studied in Iowa by Osborn ('80) in Illinois by Stormont and in Maine by Patch and referred to by other writers. The more essential points in the life cycle with reference to control may be stated briefly as follows:

The winter is passed in egg stage and in part by adult wingless-asexual females. The progeny of early spring broods developing first from stem mother are wingless oviparous but about May there is a generation of winged individuals that by a general flight serve to scatter the species in all directions. The later summer generations are wingless and wingless oviparous females provide the eggs which are destined to survive the succeeding winter and produce the stem mothers for the succeeding season. The cottony covering protects them fairly well against sprays unless driven with such force as to dislodge them and this may be done for lawn trees where water pressure is available by drenching the trees with a stream of water as well as with a contact spray,

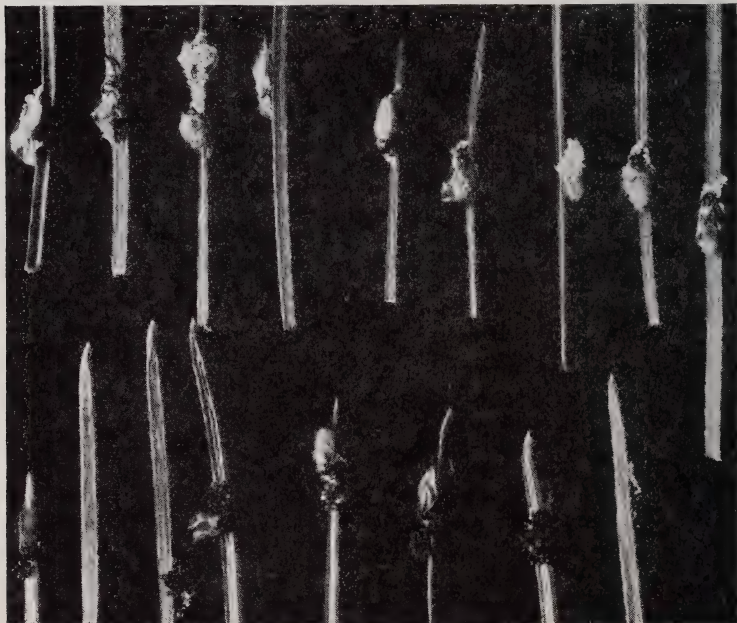


Fig. 42.—Pine leaf Chermes (*Chermes pinifoliae*) showing position in egg deposition. Note egg masses in front of insect at several points. Photo by Fivaz. (See note, p. 104.)

although the latter if under equal pressure might have added advantage of killing the insects and preventing a return of pests by development of new generations from chance individuals surviving the spray.

In extensive forest areas or in large parks where direct applications are impracticable or impossible it may be advisable to cut the badly infested trees and burn the infested branches and twigs to prevent them from serving as centers for the multiplication of the insect and their distribution to healthy trees. This has the further advantage of directing the natural enemies which on the whole are the main factor in preventing wholesale damage by the pest to those trees that are less infested and thereby reducing the numbers of the pest. Care in freeing nursery stock by spraying or fumigating before planting should serve to prevent some of the damage in newly planted forest areas.

Natural enemies that have been noted are chrysopas, syrphids and mites; and these play an important role in reducing the numbers of the pest.

THREE-SPOTTED PSYLLIA

Psyllia trimaculata Crawford

Psyllia astigmata Crawford

This species (Fig. 43) is a very conspicuous feature of the locality, both nymphs and adults appearing in such numbers and distributions as to attract attention.

The nymphs were first noted as abundant on the Fire cherry (*Prunus pennsylvanica*) where the white cottony or woolly masses covering the bodies of the insect and occurring on the under surface of the leaves formed a very conspicuous object. (See Fig. 44.)

Nymphs observed July 3 were in final instar and adults were observed emerging July 7. All adults noted July 7 and 8 were males, and agreed closely with descriptions and figures of *astigmata* Crawford, for which no larval history has been recorded. The woolly nymphs bear close resemblance to *P. floccosa* Patch described from alder, but adult characters appear to be sufficient to separate the two species. While a very few scattered nymphs have been well restricted to the fire cherry so this may be counted the preferred if not the only host plant. Early nymphs have not been observed but undoubtedly occur and develop during June, probably hatching from eggs which have wintered in buds or bark.

Nymphs of the last instar are light green, the wing pads whitish, broadly ovate, the head short, wider than long, as wide as prothorax. Antennae with terminal segment and apex of preceding segments, 5-6-7, black, 3-4 tinged at tip, 1-2 pale. Ocelli close to eye, dark; eyes blackish; pronotum short, beak light yellowish, dark at tip; wing pads of meso- and meta-thorax expanded, wider than abdomen; abdomen as wide as long and sub-truncate

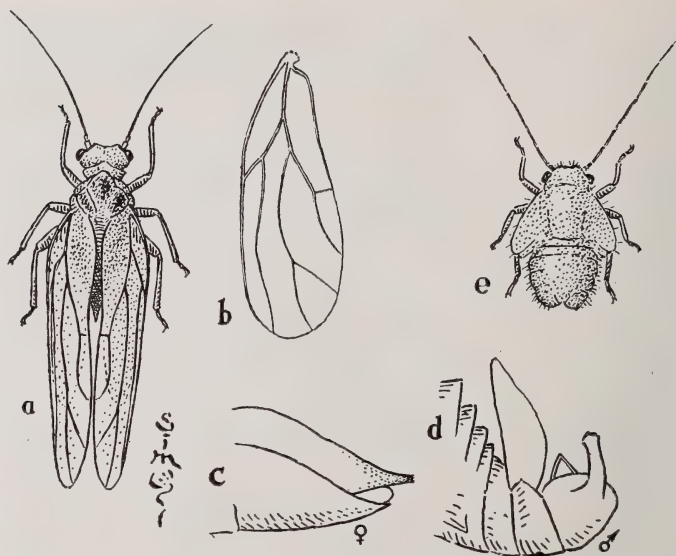


Fig. 43.—*Psyllia trimaculata* Crawford: a, adult female dorsal view; b, fore wing; c, female; d, male genitalia; e, nymph of last instar with flocculent mass removed.

behind, bearing a large mass of flocculent waxy filaments, easily detached but when the insect is moving giving the appearance of animated bits of fluffy cotton. The appearance of these cottony masses is well shown in the photo plate (Fig. 43). There are long whitish bars on the margin of wing pads and abdomen; the legs with few hairs.

Adult males were appearing fairly common July 7 and 8 and females on the 8th and 9th. Nymphs were still present on fire cherry July 20 but practically all have emerged as adult and very few of the cottony masses remain as compared with a week earlier. Many of the adults collected on fire cherry as well as from other vegetation have the orange red or red markings given as characteristic of *3-maculata*, later appearing adults seeming to furnish a greater proportion of the red marked individuals. Extended search for nymphs has failed to show any on alder or other plants on which adults are common. On August 1 no nymphs were to be found but occasional tufts of the cottony secretions and molted skins were still hanging to the leaves.

Adults taken July 28 from cherry — agreeing in every detail, except color, with earlier specimens — are nearly all deep blood red on the dorsal lobes of pro- and meso-thorax. As earlier collections and reared specimens for the early part of the month were less distinctly marked it appears probable that the different coloration is a seasonal feature due possibly to later maturity in nymphal stage, or to difference in temperature or other conditions

at time of emergence. No evidence that there is change in color after individuals are once fully mature was found as uncolored specimens kept in confinement either if bred or collected from trees showed no decided change of color when kept several days with food supply.

Adults both with and without the bright red marks have been taken in large numbers from a great variety of trees, including



Fig. 44.—*Psyllia trimaculata* Crawford: leaves (taken from fire cherry in field) show nymphs covered with flocculent masses. Photo by Drake and Fivaz.

birch, willow, aspen, maple, and on none of which have the flocculent nymphs been seen alive. Those taken on *Prunus* have the thorax of yellowish white or light greenish with three prominent orange or red spots on the three lobes; the abdomen is green; tip of upper genital valve, tarsal spurs, claws and antennae, except at base, are black; eyes black. The evidence given in brief above seems to warrant the conclusion that *P. astigmata*, as suspected by Crawford, is only an uncolored form of *P. maculata* and as *P. maculata* has priority, the former species becomes a synonym.

It seems also fair to infer from the seasonal history and the habits of related species that eggs are deposited in fall, probably in or around the buds of fire cherry, where they remain till the following summer when they hatch, and develop as the cottony covered nymphs of June and July.

NOTE REFERRING TO FIGURE 42

Chermes pinifoliae Fitch. This species, illustrated in Fig. 42, page 100, is not discussed in detail, our observations being quite fragmentary, but it may be mentioned that females ovipositing on pine leaves were seen to extrude eggs and, after laying a mass of 35 to 40 eggs, to turn around and deposit another mass, proving very definitely that Fitch's conclusion that eggs were not extruded but held within abdominal walls, the dead insect adhering to the leaf, is not the rule for the species.

CONTRIBUTION TOWARD THE LIFE HISTORY OF GALEATUS PECKHAMI ASHMEAD

BY CARL J. DRAKE

This curious and interesting American insect was described by Ashmead (1887, p. 156) as *Sphaerocysta peckhami* from two specimens collected near Milwaukee, Wisconsin, by Prof. Geo. W. Peckham. A number of years later Van Duzee (1889, p. 5) records the insect from an island in Muskoka Lake, Canada, and transfers it to the Genus *Galeatus* Stal, where the species correctly belongs. In regard to its habitat Van Duzee (*l. c.*) says: "Swept from low weeds—probably a dwarf vaccinium or a species of aralia, which were growing close together—among pines on a rocky island" (collected between July 25 and August 3, 1889).

Uhler* (1904, p. 362) greatly extends the range of *G. peckhami* and lists the insect from Las Vegas, Hot Springs, New Mexico (collected by Schwarz and Barber, August 3, at an altitude of about 6,770 feet). Bueno (1915, pp. 278 and 279) enumerates the species among the insects taken in beech drift of Lake Superior at Marquette, Michigan, in July by Mr. John D. Sherman, Jr. The latter lot contained thirty-two specimens, which seems to indicate that the insect must have been migrating in considerable numbers. The species has recently been reported from Maine (Parshley, 1917, p. 55), New Hampshire (Parshley, 1916, p. 105) and New York (Drake, 1918, p. 86). Dr. H. H. Knight has kindly sent me a few specimens from Duluth, Minnesota. In addition to most of these records Van Duzee (1917 b, p. 216) catalogues the insect from Manitoba and Uhler (1896, p. 265) also records the species from Japan.

During the past summer (1920) Dr. Osborn and the writer found the insect breeding in great numbers upon aster, *Aster macrophyllus* L., and boneset, *Eupatorium* sp. (*vide* Dr. H. P. Brown) on the summit of Crataegus Hill, Barber Point, during the last week of July. At this time all the nymphs had attained the mature state. A careful examination of the ventral surfaces of the leaves of the asters revealed the cast-off skins of four different instars still clinging to the leaves. The skins of the last three instars were in almost perfect condition and the figures and descriptions of the nymphal instars have been made from these cast-off skins.

The eggs of *Galeatus peckhami* Ashm. are almost entirely inserted in the stem of the host plant, usually somewhat near the surface of the ground, upon which the insects are feeding. They are generally placed singly (Plate IV, Fig. *e*) and in no definite

* Horvath has recently described this form from New Mexico as a new species of *galeatus*.

order in the stems of the plants. Only a small portion of the egg or the neck-like structure and cap protrudes from the plant. However, occasionally two or rarely three eggs are inserted in the same slit or egg puncture. Sometimes five or six or even a dozen eggs may be laid in rather close proximity to each other. They are deposited during the latter part of July, August and September. In proportion to the size of the abdomen the eggs are quite large and only a few fully formed ova can be contained within the body of the female at the same time. This probably accounts for the long period of egg-deposition. There is but a single generation a year in the Adirondacks and field observation indicates conclusively that eggs, which are laid during the latter part of the summer do not hatch until the following spring. Asters, in which eggs had been deposited in the stems in the field, were transferred to small pots and placed in the laboratory at Syracuse. Adult males and females were also carried to Syracuse on the host plants, but all died during the latter part of September and October. The plants were destroyed by mildew during November and December. The eggs, which had been deposited during July or later, failed to incubate in the laboratory, but seemed to have remained in a living state until they were destroyed by desiccation of the stems of the asters a few weeks after the plants had been killed by the mildew.

The egg (Plate IV, Fig. *e*) is slightly curved, from .7 to .8 mm. long and about one-third as wide. The cephalic end is distinctly neck-shaped and closed by a round cap or lid. The color varies from brown to dark brown or black, usually considerably darker on the cephalic half and with a much lighter cap.

Number of Instars: Exuviae, representing four different instars, were found clinging to the ventral surface of the aster leaves during August. This material seems to indicate five instars, but the cast-off delicate skins of the younger nymphs were badly mutilated and in no condition for a drawing or detailed description. The cast-off skins of the last three instars were very common and many were in almost perfect condition. Although I have assumed five instars, I am not positive whether there are four or five nymphal stages.

Second Instar?: Antennae stout, clothed with a few long setae, the third segment about a third longer than the fourth. Head with five slender bristle-like spines. The spines along the margins of the thorax and abdomen, also median erect ones, slender and bristle-like. The spines on the head are located in this instar and also in the others as in the adult insect. The spines on the thorax and abdomen are placed as in the two following instars (the position and location described in next instar), but some are wanting in the last instar. Some of the bristle-like spines on the abdomen are double (two arising from almost the same base). Nine abdominal segments visible above. General color testaceous, with very few or no brownish markings.

Third Instar? (Plate IV, Fig. *k*): Cephalic spines moderately long blunt, the median one usually a little longer than the others. Antennae stout, the third segment about one and three-fourths times the length of the fourth. Outer margins of pro-, meso-, and metathorax on each side armed with a long spine; the middle of both pro- and mesothorax with an erect spine on each side of the median line. Abdominal segments two, three, four, five, six, seven and eight armed on each side near the postero-outer margin with a long spine, the ninth segment with two long spines; segments two, five, six and eight each armed with an erect spine on the median line, usually two or three or all these spines with a double-pointed tip. The spines in this instar are rather stout and blunt. Length, 1.1 mm. General color testaceous, with a few small brownish spots.

Fourth Instar? (Plate IV, Fig. *i*): Spine on head thorax and abdomen arranged as in the preceding instar, but all much longer and pointed. Body and spines sparsely clothed with moderately short spine-like structures with a bulbous or knobbed tip. Antennae with the third segment a little less than twice as long as the fourth. Mesothorax distinctly larger than in the preceding instar. Length, 1.65 mm. General color testaceous, with small brownish areas at the base of some of the spines. Spines more or less brownish.

Last Instar (fifth?) (Plate IV, Fig. *f*): In this stage the spines on the head and thorax are longer than in the preceding instar. The spine-like structures with bulbous tips are also a little longer and more numerous. (Plate IV, Figs. *h* and *i*.) Pronotum large, the posterior process subtruncate. Mesothoracic wing pads large, somewhat leaf-like, projecting on the fifth abdominal segment and completely covering the metathorax and metathoracic wing pads. Abdominal segments two and three with the marginal spines wanting, also spines along margin of metathorax. Spines along the median line of the pro- and mesothorax and median spines of abdomen, especially prothoracic ones, with raised somewhat bulbous areas at the base. Antennae slender, clothed with several setae, the second segment twice the length of the fourth. Occasionally, one of the spines on the head or abdomen are double (two spines arising from almost the same base). A couple specimens in both the fourth and fifth instars have been found with an extra spine on the head (six spines) and one or two extra on the abdomen. As a rule, however, the number of spines seem to be quite constant. Length, 2.8 mm. General color testaceous, variegated with brown or fuscous. Spines more or less brownish.

The adult of *Galeatus peckhami* is only known to occur in the macropterous form. Several Palaearctic species are found in both brachypterous and macropterous forms. The head normally bears five long spines and it is very rare that one finds an individual with six spines. The posterior extension of the pronotum is somewhat inflated and the median carina is well developed. The hood is rather high, not broad and covers the base of the head.

The lateral carinae are enormously developed, somewhat ovoid in outline and form sort of a discal hood-like structure. They extend considerably above the median carina, with the front margins in contact with each other, the posterior ones distinctly separated, and each constricted near the middle above. The areolae of the hood, carinae, paranota, posterior extension of pronotum and elytra are very large. The nervures are brownish or fuscous, the areolae are mostly hyaline, sometimes a few slightly clouded. The length varies from 4.2 mm. to 4.5 mm.

Four predaceous insects, *Podisus serieventris* Uhl. *Podisus modestus* Dall., *Nabis rufusculus* Reut. and *Nabis roscipennis* Reut. were collected on the same plants with *G. peckhami*. In fact the eggs of *Nabis rufusculus* were found in stems of the asters near the eggs of *G. peckhami*. Two associated forms, *Macrotylus sexguttatus* Prov. and an undetermined aphid, were feeding and breeding in considerable numbers on the same asters. The insect lives in dry and somewhat open places; it was only taken on the crest of this small hill and seemed to be very locally distributed. It is not known whether the adults survive the winter or not. Data seems to indicate that the winter is spent in the egg stage.

PLATE IV

Galeatus peckhami Ashmead

- Fig. a, dorsal view of adult.
 Fig. b, lateral view of adult showing pronotum and head.
 Fig. c, male genitalia showing claspers.
 Fig. d, ventral view of female genitalia.
 Fig. e, eggs in stem of aster. Part of the stem has been removed to show how deeply eggs are inserted in plant. Note how stem is slit for the insertion of an egg.
 Fig. f, dorsal view of last nymphal instar (5 instar?).
 Fig. g, large spine of last instar greatly enlarged.
 Fig. h, small bulbous-like or spine-like process with knobbed tips (from last instar). These structures are found on the body and large spines (greatly enlarged) of larger nymphs.
 Fig. i, dorsal view of nymph of third(?) instar.
 Fig. j, dorsal view of nymph in next to last instar (fourth instar?).
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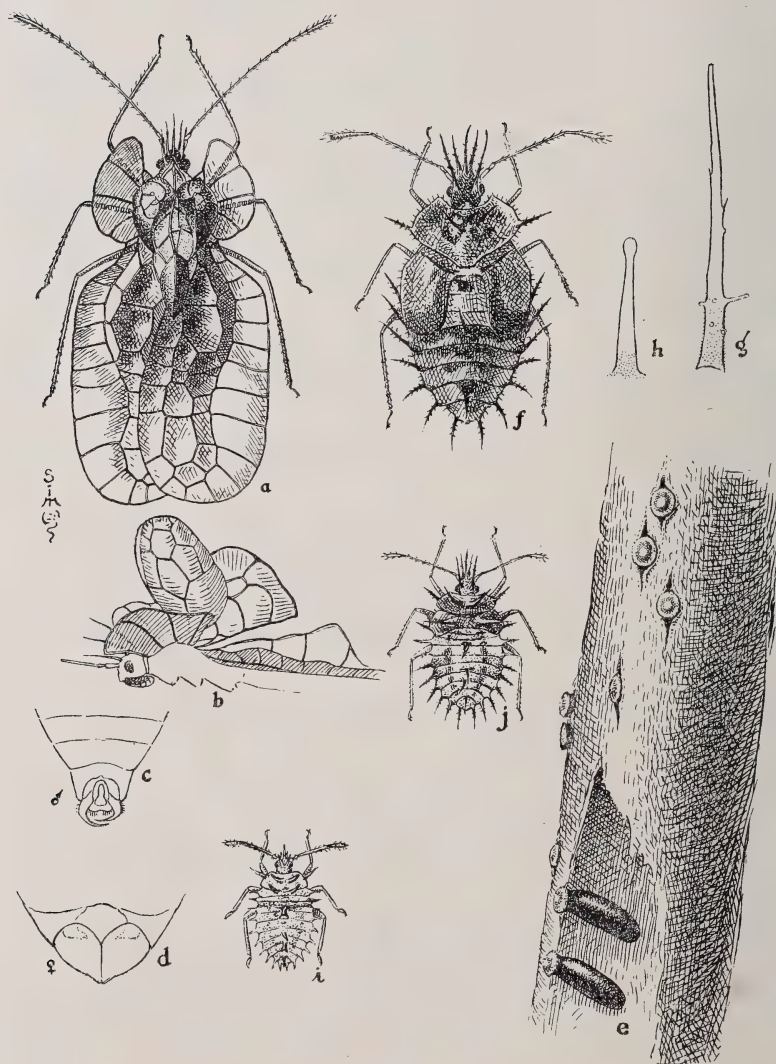


Plate IV.

THE LIFE HISTORY OF THE BIRCH TINGITID, *CORYTHUCHA PALLIPES* PARSHLEY

BY CARL J. DRAKE .

The yellow birch tingitid made its appearance under three different names — viz., *pallipes* Parshley, *cyrta* Parshley and *betulae* Drake — in the same paper by Gibson (1918, pp. 69–105) on the study of the Genus *Corythucha* Stal. According to pagination *pallipes* has page-priority and is the valid name for the species. Parshley (1920, pp. 28 and 29) has recently pointed out the fact that *cyrta* and *betulae* are identical. Dr. Parshley has kindly loaned me the type series of *pallipes* and *cyrta* and we are fully convinced that *cyrta* and *betulae* are not only specifically the same, but also synonymous with *pallipes*. Although *cyrta* and *betulae* can be connected up in the type series, Gibson (*l. c.*, p. 86) failed to observe this identity. Lack of food-plant data and a series showing variability accounts for the original failure to note the kinship of *pallipes* and *cyrta*.

The yellow birch tingitid is undoubtedly the most common species of Heteroptera living in the vicinity of Cranberry Lake. It seems to show a decided preference for yellow birch, *Betula lutea* Michx. f., but it is also very common on white birch, *Betula alba* L., beech, *Fagus grandifolia* Ehrh. and ironwood or hop hornbean, *Ostrya virginiana* Mill. K. Koch. Dr. Osborn noted a young mountain ash, *Pyrus americana* (Marsh) DC. badly infested by *pallipes* at Barber Point in July. The writer also found the insect breeding on mountain maple, *Acer spicatum* Lam., soft maple, *Acer saccharinum* L., hard maple, *Acer saccharum* Marsh, and striped maple or moosewood, *Acer pennsylvanicum* L., but the species seems to breed only occasionally and never in large numbers on maples. The type series of *pallipes* (1918, Parshley in Gibson, p. 86) were collected on an introduced willow, *Salix sieboldiana*, at Stanford, Connecticut, by Mr. W. E. Britton. I have seen several other specimens, bearing the same date, locality and food-plant, that must have been collected with the types by Mr. Britton. The number of specimens would seem to indicate that the insect must have been at least feeding and perhaps breeding on the introduced willow. The insect has not been observed to feed or breed on the willows (growing near badly infested birch trees) in the Cranberry Lake region. Parshley (in Gibson, 1918, p. 85) also states that this insect (under *cyrta*) has been taken on sphagnum, but does not list this as a food plant. Two or three published records report *Corythucha juglandis* Fitch upon birch, but these probably refer to *pallipes*. In fact I have seen *pallipes*, bearing food-plant label "birch", in a few collections wrongly determined as *C. juglandis* Fitch. *Corythucha pergandei* Heide-mann and *Corythucha heidemanni* Drake occasionally feed and

breed on birch, but alder is by far the most common and the preferred food-plant of these species.

Distribution: *C. pallipes* is a transcontinental species and probably occurs throughout the northern part of the United States and southern Canada. Specimens are at hand from New York, Massachusetts, Maine, New Hampshire, Connecticut, Michigan, Wisconsin, Oregon, Washington and Canada (Ottawa and Manitoba).

Variation: Like a number of its congeners, *pallipes* shows considerable variation in size, shape of the hood, and also in the relative proportion of the height of the crest of the hood with the height of the median carina. There is also a moderate degree of variation in size and general color of the entire insect. This variation accounts largely for the synonymy of the species. The adult insect ranges from 3.5 mm. to 4.32 mm. long. In relation to the median carina, the height of the crest of the hood varies from about twice to approximately three times that of the median carina. The posterior portion of the hood also varies considerably in width. On the same food plant one can find the extremes of variations as well as gradual gradations leading to all intermediate forms. There seems to be no distinct varieties, but the most common form generally has the hood a little larger than the type (*pallipes*). There is also a little variation in the height of the lateral carina.

Injury (Fig. 45): This tingid occurs on the yellow birch trees by the thousands and it is undoubtedly the most injurious leaf-feeding insect upon the yellow birch tree in the vicinity of Cranberry Lake. Although large trees are frequently infested it seems to prefer the younger trees and seedlings. During the summers of 1917, 1918, 1919, and 1920 the insect has been especially abundant in the vicinity of Barber Point. Numerous young birches were so badly infested that the leaves were almost entirely discolored by its feeding punctures. In fact, the discolored leaves of badly infested trees by the last of July would attract one's attention several yards away. Later, many of these leaves would be almost entirely destroyed. Ironwood probably ranks next to yellow birch as a preferred food-plant, but white birch and beech are often badly infested. Mountain ash and the various species of maples do not seem to attract the insect very frequently and never in great numbers; in fact they are very rarely infested at all. There are two generations a year in the Adirondacks, the second generation hibernating as adults over the winter among the fallen leaves on the ground.

The adults and nymphs feed almost entirely on the under-side of the leaves (Fig. 45). The young nymphs, especially during the first and second instars, feed largely in colonies, but they gradually scatter during the older stages. The discoloration, caused by the feeding of the insects, is very conspicuous on both sides of the leaves (Fig. 45). In addition to these discolored and feeding areas there are small blackish spots on the under-side of the leaves where the faeces have been deposited.

Natural Enemies: Two predaceous insects, a little anthocorid, *Anthocoris borealis*, and the larvae of a lace-winged-fly, *Chrysopa* sp., were observed feeding upon both nymphs and adults in the field. Adults are also occasionally parasitized by a small red mite, *Trombidium* sp., the latter usually being attached to the ventral side of the abdomen.

Eggs: The eggs are deposited on the under-side of the leaves in the axil of the veins. They are placed on end (only the base of each egg being slightly inserted in the tissue of the leaf) and in no definite order, but usually in groups ranging from four to ten eggs each. Sometimes only one and at other times about a dozen or more eggs are laid in a single group. The eggs are fairly well concealed on yellow birch leaves by the pubescence along the veins of the leaves.

The egg (Plate V, Fig. *e*) is sub-elliptical, slightly curved, about .6 mm. long and not quite one-third as wide. The cephalic end is somewhat constricted and closed by a cap or lid. The color varies from brown to a very dark brown, but the cap is always much lighter and of a grayish color. They hatch about ten days after deposition.

First Nymphal Stage (Plate V, Fig. *d*): Much more cylindrical elongate, and thicker than in the other instars. Antennae composed of three segments, the third long and with a few long setae. Head with five tubercles, the anterior pair with a single spine on each, the median and the posterior pair with two spines on each. Abdominal segments two, three, four, five, six, seven, eight and nine with a small tubercle, bearing a slender spine, on each side. Both pro- and mesothorax armed on each side with a spine. Abdominal segments two and eight bearing a pair of small dorsal tubercles with a spine on each; segments five and six with large and prominent dorsal tubercles, each tubercle bearing three slender spines. Mesothorax also with a dorsal pair of tubercles, each bearing a slender spine. Length, .61 mm.; width, .15 mm. At time of hatching the nymph is almost colorless. Fully matured specimens are of a rather dark brown color. This instar lasts from four to six days.

Second Nymphal Stage (Plate V, Fig. *e*): Body broader in proportion to its length than in the preceding instar. The tubercles on the head are a little larger. The spines along the margin of the abdomen are stronger and larger and the spicules are more numerous over the entire body. Length, .75 mm.; width, .43 mm. Color, dark brown. The length of this instar varies from five to ten days.

Third Nymphal Stage (Plate V, Fig. *f*): Antennae with four segments. The pro- and mesothorax larger and the entire insect more oval in outline. A few small spines have appeared on the tubercles. Length, 1.01 mm.; width, .64 mm. General color, dark brown. Length of instar, four to eight days.

Fourth Nymphal Stage (Plate V, Fig. *g*): Tubercles moderately large, each bearing several spines. Prothorax considerably larger, the mesothoracic wing-pads quite prominent. Small spicules have appeared on the bases of large spines. Length, 1.68 mm.; width, .76 mm. General color, dark brown, the base of the abdomen with a lighter area. Length of instar, five to twelve days.

Fifth Nymphal Stage (Plate V, Fig. *h*): Tubercles on the head quite large and prominent, each bearing several spines. Tubercles and spines much larger. Spinules present as in the preceding instar. Prothorax very prominent, the median anterior portion considerably raised and inflated, mesothoracic wing-pads very large, completely covering metathoracic wing-pads and extending on the fourth abdominal segment. Spines on lateral margins of abdominal segments covered by wing-pads wanting. Length, 2.2 mm.; width, 1.3 mm. The general color is dark brown, the yellowish areas on the prothorax, wing-pads and base of the abdomen have increased in size. Length of instar, eight to fifteen days.

PLATE V

Corythucha pallipes Parshley

- Fig. *a*, adult.
Fig. *b*, lateral view of hood and median carina.
Fig. *c*, egg.
Fig. *d*, first nymphal stage.
Fig. *e*, second nymphal stage.
Fig. *f*, third nymphal stage.
Fig. *g*, fourth nymphal stage.
Fig. *h*, fifth nymphal stage.
Fig. 45, Yellow Birch Leaves showing eggs, nymphs and adults. Note discolored areas caused by feeding punctures.

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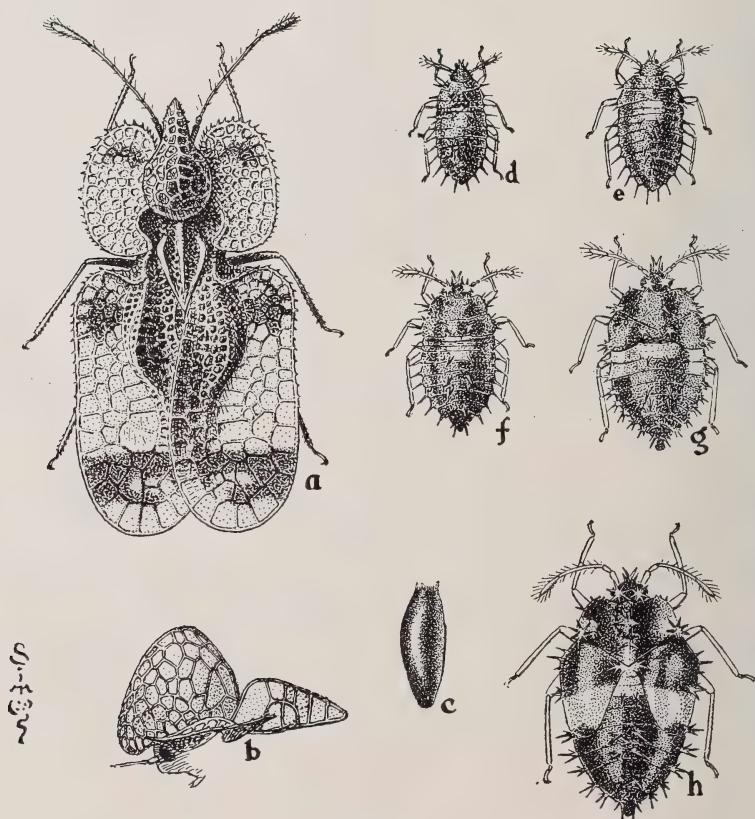


Plate V.

NEW SPECIES OF IPIDAE FROM MAINE*

BY M. W. BLACKMAN

Professor of Forest Entomology, New York State College of Forestry, Syracuse, N. Y.

The writer spent the four months from June 18 to October 18, 1919, investigating certain forest insects for the Maine Forestry Department in co-operation with the Maine Agricultural Experiment Station. In this work the chief attention was paid to the *Ipidae*, commonly known as the bark-beetles, and large numbers of specimens were collected, not only in the vicinity of Orono, but in several localities between Bangor and Kittery Point, in the Rangeley Lake region and in regions near Umbazooksus, Chamberlain and Telos Lakes. In the course of the work several new species of bark beetles were found, including those described herewith.

The writer wishes to express his appreciation of the courtesies extended by Professor J. M. Briscoe, of the Department of Forestry, and Doctor E. M. Patch, Entomologist of the Experiment Station, during the course of the work.

Xylechinus americanus n. sp.

Description of the adult: Dark brown, with antennae and legs lighter in color; 2.2 mm. long, 2.44 times as long as wide, with the head visible from above.

Front of the head plano-convex, finely punctate and granulate, with numerous, fine, rather short, greyish hairs directed mesially, the median carina sharply and distinctly elevated below but broken up into a row of coarser granules above, with a faint arcuate transverse depression originating at the level of the middle of the eye, the epistomal margin produced in the median third, with the prolongation emarginate at the median line; vertex and genae reticulate, finely punctured, with a few minute hairs; *eyes* elongate, moderately coarsely granulate, with the inner margin scarcely sinuate; *antennal* club connate, very slightly flattened with three sutures visible all around and nearly straight; funicle of about the same length, with five segments, the distal ones slightly wider.

Pronotum 1.1 times as wide as long; widest behind with the sides subparallel on the posterior half, constricted before the middle, rounded in front and with the hind margin bisinuate; disc and sides closely punctured and finely granulate, clothed with cinere-

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ous scale-like hairs which are directed mesially and meet in the median line over a faint median carina which would otherwise be inconspicuous.

Elytra distinctly wider than the pronotum, 1.67 times as long as wide, widest behind the middle; the sides subparallel, slightly sinuate, very narrowly rounded behind; basal margins separately rounded, strongly elevated from scutellum to humeral angle and bearing a row of rather slender flattened teeth with rounded points; striae moderately narrow, rather strongly impressed, with regularly placed, deep, coarse punctures; interspaces wider, convex, granulate-punctate, clothed with cinereous scale-like hairs of two sorts—a median row down the center of each interspace, longer, wider, suberect and better developed posteriorly, and more numerous, smaller, appressed ones arranged at each side and between the coarser ones. *Declivity* regularly arched with the sutural interspace wider and more strongly elevated. First two and last ventral segments subequal and each as long as the third and fourth combined, the last one rounded behind; all clothed with fairly abundant, cinereous hairs, longer and more plentiful on the last segment.

Type—Orono, Maine, Aug. 15, 1919, M. W. Blackman, collector; Lot No. M-144-b.

Host Trees—White pine (*Pinus strobus* L.), white spruce (*Picea canadensis* Mill.) and red spruce (*Picea rubens* Sarg.).

This species which is apparently the first of the genus to be recorded from North America is closely allied to *Xylechinus pilosus* Ratz. but is plainly distinct. On comparison with the European species, a specimen of which has been given me by Doctor J. M. Swaine, the following points of difference are found: The elytral sculpture is considerably coarser in the American species, with the striae deeper, the striae punctures larger and the declivital granules coarser; the elytral vestiture differs in that the central row in each interspace is here longer and more erect than in *pilosus* and also in the absence of the white band formed by the more plentiful vestiture in the sutural interspaces; the ground color of the elytra is darker as is also the vestiture; the vestiture of the front of the head is also longer and the median carina is more strongly developed. This species is apparently the first of the genus to be reported from America, north of Guatemala. Blandford assigns five species from Panama and Guatemala to this genus and a single species has been described by Hagadorn from Argentina. In Europe but the one modern species already mentioned is known.

X. americanus was taken by the writer in Maine on only two occasions. On August 15, 1919, two individuals were found in their newly started burrows in the bark of a small white pine tree dying from suppression. On October 13, however, a number of brood burrows were found in a small recently dead white spruce tree and these contained a number of young adults and a few

larvae. This small tree occurred in a very dense stand of spruce, and it also had been so greatly weakened by overshadowing as to make it a suitable breeding place for the beetles.

During the summer of 1921 the writer also obtained a number of specimens from red spruce at Cranberry Lake, N. Y. The dates of collection are June 24, July 17, Aug. 3 and Aug. 5, 1921. All were obtained from small, shaded-out red spruce trees and the beetles were present in only small numbers.

The burrows consist of an entrance tunnel which leads directly into a rather large irregular shaped nuptial chamber. In the majority of cases but two egg-galleries lead off from the central chamber and usually extend in a nearly transverse direction. In several burrows, however, one or more additional galleries are to be found. These are in all cases short, are nearly at right angles to the first two and contain only a few egg-niches. The number of egg-niches in an egg gallery varies from 8 to 29 in those counted and the number of niches to the engraving varies from 21 to 54.

As regards its economic importance the species seems not to be at all common and all of the trees in which it was found were such as had been either greatly weakened or actually killed by suppression. In white pine it was associated with *Ips pini* Say, *Pityophthorus granulatus* Sw. and *P. nudus* Sw. While in white spruce no other bark beetle occurred in the same region of the tree, but *P. opaculus* Lec. and *Cryphalus mainensis* n. sp. were breeding in the limbs and twigs.

***Pityophthorus balsameus* n. sp.**

Description of adult female: Very dark reddish brown, almost black; 1.88 mm. long, 2.87 times as long as wide.

Front flattened, with a reniform, spongy area of a light reddish-brown color; median carina indicated by a distinct tooth just above the epistomal margin; marginal hairs abundant near the broadly emarginate center, sparse laterally; remainder of frons rather coarsely and roughly punctured; apparently glabrous; *eyes* emarginate; *antennal* club nearly as broad as long, first and second sutures similarly, third suture more strongly arcuate; club at least one-fourth longer than funicle.

Pronotum 1.2 times as long as wide. posterior half with sides subparallel, broadly rounded in front; front margin distinctly serrate; anterior area moderately asperate; summit prominent, with well-marked, wide, transverse impression behind the summit, divided by a shining, impunctate, slightly raised, median line; with a similar but less prominent longitudinal lateral elevation at each side; posterior half of disc with deep, moderate sized punctures, sides rather more densely but less deeply punctured.

Elytra wider than thorax, 1.78 times as long as wide; sides very faintly arcuate, very broadly rounded behind but slightly produced at the suture; striae not impressed except the first, striae punctures rather coarse, in rows, somewhat irregular near suture;

interstrial punctures similar to striae, but sparse, more numerous at the sides; disc of declivity shining, sparsely pubescent with short inconspicuous hairs which are longer and more numerous at the sides and rear. *Declivity* with narrow moderately shallow sulcus; suture moderately elevated, not granulate; lateral elevations each with a sparse row of small short blunt tubercles on the third interspace.

Male with the front coarsely, roughly punctured, with distinct, median, narrow, elevated carina below, ending above the epistomal margin in a distinct tooth-like structure, with some indication of a transverse carina at level of upper angle of eye; pronotum broader than in female, as wide as elytra; declivity very narrowly sulcate; sulcus nearly eliminated at its center by an inpushing from each lateral convexity; lateral elevations devoid of granules, each, however, with a blunt tooth-like prominence, with its apex in line with the second stria but belonging to the third interspace.

Type — A female, Orono, Maine, July 12, 1919, M. W. Blackman, collector; Lot No. M-86-b.

Host tree — *Abies balsamea* (Linn.) Miller.

Described from a series of seven females and two males collected by the author at Orono, Maine, July 8, 12, 17, 19 and at Chemo Lake, August 18, 1919. All of these specimens except one of the males were taken from their burrows in the twigs of balsam fir. The male collected at Chemo Lake was in a twig of red pine (*Pinus resinosa* Ait.).

All of the brood-burrows found were in twigs or small limbs less than one-third of an inch in diameter. These galleries are of the type common to the genus, consisting of a rather large nuptial-chamber from which originate several egg-galleries. These latter are rather short and groove the sapwood deeply. The burrows studied were invariably found to originate at the base of a smaller branch or twig where the bark is usually rougher and thicker. This species was found only in dying or recently dead twigs of balsam and was not taken in healthy material. It is probably of little economic importance. It was associated in balsam with *Pityophthorus canadensis* Sw. *P. puberulus* Lec., *P. opaculus* Lec. and *Cryphalus balsameus* Hopk. In red pine it was found in the same twigs as *P. canadensis* Sw. and *P. puberulus* Lec.

Pityophthorus patchi n. sp.

Description of adult female: Very dark reddish brown; 1.97 mm. long, 3.1 times as long as wide.

Frons plano-convex on a nearly circular area extending nearly from eye to eye; with an oval, densely pilose or spongy, slightly elevated portion at the center, the long diameter vertical and the transverse diameter about half that of the entire front; pilose area divided vertically by an indistinct carina ending in a small but distinct tooth just above the epistomal margin; lateral non-pilose area moderately punctured, more roughly above, with very

fine and short hairs; epistomal margin sinuate, with a border of stiff hairs longer at the center (abraded in old specimens); *eyes* broad oval, broadly, rather deeply emarginate; *antenna* of but little lighter color than the remainder of the body; club considerably longer than funicle, more than one-fourth longer than wide, with the first suture nearly straight, the second curved and the third strongly curved.

Pronotum 1.26 times as long as wide; sides subparallel for nearly two-thirds of the posterior part, then very slightly constricted and broadly rounded in front; front margin feebly serrate; anterior area moderately asperate; summit prominent, with broad, deep, transverse depression posteriorly; median impunctate area of posterior half slightly elevated, disc and sides moderately but deeply punctured, with a few short fine hairs; posterior marginal line distinct, slightly bisinuate.

Elytra wider than pronotum, 1.86 times as long as wide; widest before the middle, sides subparallel, weakly arcuate, broadly rounded behind; striae not impressed except the first, stria punctures of moderate size, but deep and not arranged in regular rows, those of the interspaces numerous, and similar; disc shining, nearly glabrous; pubescence at sides not so sparse. *Declivity* narrowly, deeply sulcate, suture elevated, narrowed midway in the declivity but wider toward the summit and apex; lateral prominences high, each with a sparse row of minute tooth-like granules; hairs short and sparse.

Male slightly smaller but of the same general proportions; front similarly plano-convex, with a small, sub-circular area at the center clothed with short hairs and divided by an indistinct carina ending in an epistomal tooth which is coarser than in the female; with the outer area of the front coarsely and roughly punctured; lateral elevations of the declivity not quite so high, with the granules smaller and more sparse.

Type — A female, Orono, Maine, Aug. 20, 1919, M. W. Blackman, collector; Lot No. M-155.

Host Trees — Balsam fir (*Abies balsamea* (Linn.) Miller), white pine (*Pinus strobus* L.) and white spruce (*Picea canadensis* (Mill.) B., S. & P.).

Described from a small series of eight specimens obtained by the writer July 12, August 5 and 20, 1919. The beetles were found in their burrows in dying and recently dead twigs, the entrance opening always occurring at the base of a small branch. The nuptial chamber is large and the burrow as a whole often approaches the cave type characteristic of such species as *Cryphalus balsameus* but some of the burrows also show short egg-galleries. The eggs are placed in niches either in the walls of the egg-galleries or in those of the nuptial chamber.

In balsam twigs *P. patchi* was associated with *P. canadensis* Sw., *P. balsameus* n. sp. and *Cryphalus balsameus* Hopk.; in white spruce with *P. canadensis*; while no associates were found in the same twigs from white pine.

The species is named in honor of Dr. E. M. Patch, Entomologist for the Maine Agricultural Experiment Station.

Pityophthorus biovalis n. sp.

Description of adult female: Dark reddish brown; length, 1.9 mm.; three times as long as wide.

Front with a concave area of three-fourths of a circle, extending from eye to eye, bordered with moderately long, stiff, slightly incurved hairs, divided longitudinally by an elevated ridge or carina which is sulcate along its summit and sparsely pubescent with short, stiff hairs on the upper two-thirds, with a rather deep, oval, glabrous and shining concavity at each side; epistomal margin sinuate, with short, stiff hairs slightly longer at the center. *Eyes* distinctly emarginate. *Antennae* lighter in color, club more than one and a half times as long as funicle, oval, first two sutures subequally arcuate.

Pronotum 1.26 times as long as broad; sides subparallel on the posterior part, slightly constricted in front of middle, and broadly rounded anteriorly; front margin serrate; anterior half moderately asperate; summit prominent; transverse depression fairly pronounced; median and lateral impunctate areas slightly elevated; posterior half of pronotum moderately, rather finely, but deeply punctate on the disc and sides; posterior marginal line distinct, slightly sinuate.

Elytra wider than thorax, sides slightly arcuate; very broadly rounded (sub-truncate) behind; first stria impressed, the others not; strial punctures of moderate size, deep, in not entirely regular rows; punctures of the interspaces nearly equal in size, not numerous but more so in the second interspace and at the sides, disc shining and appearing glabrous from above, but with a few short hairs which are more numerous and longer at the sides. *Declivity* abrupt, with rather deep, shining sulcus, suture elevated, rather narrow; lateral elevations high and abrupt, each with a row of small, irregular, blunt teeth along its summit.

Male of the same general proportions, but slightly smaller (length 1.85 mm.) front plano-convex, sulcate along the median line, with a light reddish-brown, oval area at each side, each appearing spongy at its center, shining and glabrous at its periphery; declivity with sulcus narrower than in the female, with the lateral elevations apparently not so high, but with a blunt tooth-like prominence opposite the third interspace.

Type — A female, Brunswick, Maine, June 29, 1919, M. W. Blackman, collector, N. Y. S. Col. For. Lot No. M-62-a.

Host Trees — Red spruce (*Picea rubens* Sarg.) and white pine (*Pinus strobus* L.).

While but one specimen of each sex of this species was taken the characters, especially those relating to the female frons are so strikingly different from known forms that it is readily separated by them alone. The female was taken June 29 from the twigs of

red spruce felled a few weeks previously, where it was associated with *P. briscoei* n. sp., *Dryocoetes americanus* Hopk. being common in the larger portions of the limbs. The male was derived from white pine twigs from Mt. Desert Island, Maine, Aug. 19, 1919, and was there associated with *P. pulicarius* Zimm.

***Pityophthorus briscoei* n. sp.**

Description of the adult female: Very dark brown, almost black; 2.0 mm. long, three times as long as wide.

Front of head with a nearly circular concavity extending from eye to eye, with dense, yellowish brown plush-like pubescence, slightly longer at the lateral margins, divided by a median vertical sulcus which is shining, apparently impunctate and glabrous; above the concavity roughly punctured. *Eyes* rather finely granulate, with the inner line narrowly emarginate. *Antennal* club longer than the funicle, with the first two sutures curved, the third more strongly arcuate.

Pronotum 1.16 times as long as wide; sides subparallel behind, broadly rounded in front; front margin weakly serrate; anterior area moderately asperate; summit fairly prominent, wide transverse impression behind summit; median, longitudinal, impunctate line hardly elevated; posterior half of pronotum deeply, rather finely punctured on the disc and sides, with very fine and short yellow hairs; ventral surface of the prothorax impunctate and glabrous behind, punctured anteriorly.

Elytra slightly wider than thorax, 1.87 times as long as wide; with the sides faintly arcuate, widest at the middle; very broadly rounded behind and appearing sulcate-truncate from above; elytral striae not impressed, deeply, not coarsely punctured; stria punctures somewhat irregular near suture and declivity and at the sides; interspaces smooth, shining, with punctures similar to those of striae, sparse on the disc, more numerous near the declivity and at the sides. *Declivity* steep, with moderately wide, deep, shining sulcus; suture slightly elevated, devoid of granules; lateral elevations moderate, each with a few small rather closely set tooth-like granules in a row on the third interspace. Disc with minute, short, inconspicuous hairs, longer and coarser at the sides, scarcely so behind.

Male shorter and slightly wider; front flattened on a nearly circular area, rather coarsely and roughly punctured, with a distinct median carina elevated into a sharp, laterally compressed tooth slightly above the epistomal margin, with a rough, transverse arcuate ridge at the level of the upper angle of the eyes; declivity more deeply sulcate; lateral elevations each raised at its center into a blunt tooth-like prominence in the third interspace, with faint traces of granules along its anterior slope.

Type — A female, Brunswick, Maine, June 29, 1919, M. W. Blackman, collector, N. Y. S. Col. For., Lot No. M-62-a.

Host tree — Red spruce (*Picea rubens* Sarg.).

Only three specimens of this quite distinct species were taken by the writer. They were taken from a single burrow in the smaller limbs of red spruce near Brunswick, Maine, June 29, 1919. The brood burrow was in a limb about one-half inch in diameter at the base of a smaller twig. Two longitudinal egg galleries, each slightly less than an inch in diameter extend in opposite directions. In one 15 eggs had been deposited, each in a side niche while in the other 13 had been laid. Some of these had hatched. This species was found in the same sort of material as *P. biovalis* n. sp.

The species is named in honor of Prof. J. M. Briscoe, Professor of Forestry in the University of Maine.

Pityophthorus shepardi n. sp.

Description of the female: Reddish brown, length 1.75 mm.; 2.7 times as long as wide.

Front flattened on an area of more than a semi-circle, impressed on its periphery, densely and finely punctured throughout, densely pubescent with fine hairs of moderate length; remainder of the front shining, finely and sparsely punctured; epistomal margin entire, no conspicuous marginal hairs. *Antennal* club conspicuously hairy, longer than funicle, about one-fourth longer than wide, first suture nearly straight, second and third procurved. *Eyes* finely granulate, emargination about as wide as deep.

Pronotum 1.07 times as long as wide, widest posteriorly, sides sub-parallel for about half their length, then slightly constricted and rather narrowly rounded in front; anterior margin weakly serrate; anterior area moderately asperate; summit not prominent; posterior area with distinct impunctate median line; remainder of disc and sides rather finely, not densely punctured; posterior marginal line fine but distinct.

Elytra slightly wider than pronotum, widest at about the middle, 1.7 times as long as wide; sides slightly arcuate to level of declivital origin, then evenly, narrowly rounded to the suture where they meet at an angle. *Striae* not impressed except sutural striae; strial punctures fine, fairly deep near base and at the sides but becoming progressively shallower and finer posteriorly, those of the first three striae obsolescent on the disc behind; interstrial punctures very sparse; disc of elytra glistening, glabrous; sides sparsely pubescent with short, stiff hairs. *Declivity* shallowly sulcate with the sulcus shining; suture moderately wide and elevated, very feebly granulate; lateral elevations inconspicuous, each with a sparse row of very small granules on the third interspace, with one or two similar granules lateral to it, each bearing an inconspicuous, short, stiff hair.

Male of about the same general proportions as the female; front rather coarsely, deeply, somewhat roughly punctured, with faint traces of a median carina; shining, glabrous or nearly so; epistomal margin entire with a scant border of short, stiff, yellow hairs;

pronotum as wide as elytra or slightly wider; declivital sulcus deeper; lateral elevations, more pronounced, with coarser granules and longer, more conspicuous tactile hairs.

Type—A female, Township 7-R-12, Maine, M. W. Blackman, collector; Lot M-115.

Host Tree—White spruce (*Picea canadensis* (Mill.) B. S. and P.)

The type series consists of fourteen specimens collected by the writer in Township 7-R-12 in the Chamberlain Lake region of Piscataquis County, Maine, July 24, 28, 1919. The beetles were removed from their brood burrows in the limbs of a white spruce, slightly injured by a ground fire the preceding spring. The beetles breed in limbs from a half inch to an inch in diameter, the burrows being of the polygamous, radiate type, with the egg galleries which may reach a length of two inches, but are usually smaller, extending either longitudinally or obliquely from the nuptial chambers.

There is considerable variation in size in the fourteen specimens studied, the type representing about the maximum of the series. The species is named in honor of Mr. H. B. Shepard, Forester for the Eastern Manufacturing Company of Bangor, Maine.

***Pityophthorus dentifrons* n. sp.**

Description of the adult female: Very dark reddish brown, almost black; 2.18 mm. long, 2.57 times as long as wide.

Front flattened on an area of a little more than a semicircle, strongly impressed at the periphery, bordered with moderately long incurved hairs (not so long as in *pulchellus*); punctured finely but densely at the periphery which is bordered by a definite raised semicircular ridge, punctures becoming progressively sparser toward the center near the epistomal margin; area divided by a very faint median carina. *Eyes* moderately granulate, rather deeply emarginate. *Antennal* club one-half longer than funicle, nearly as wide as long, with first suture procurved, second and third progressively more strongly procurved, the first two sinuate.

Pronotum slightly wider than long, arcuate on the sides behind, slightly constricted before the middle, rather narrowly rounded in front; front margin distinctly serrate; anterior half rather strongly asperate; summit rather prominent; transverse impression just posterior to summit moderately deep, divided by a median slightly raised impunctate line, and marked off laterally by two obliquely divergent, slightly raised, impunctate lines extending only half way to the posterior margin of the pronotum, posterior margin distinct, feebly bisinuate.

Elytra slightly wider than pronotum, 1.67 times as long as wide, sides sub-parallel to level of origin of declivity, broadly rounded posteriorly; striae scarcely impressed, sutural stria more strongly, with the punctures moderately coarse and deep, in fairly regular rows; interstrial punctures similar to those of the striae but very

sparse, interspaces rugulose; disc of elytra shining, nearly glabrous, pubescence more abundant at sides. *Declivity* shallowly but widely sulcate, sulcus shining; suture moderately wide and elevated, with a sparse series of rather coarse, blunt, tooth-like granules; lateral elevations each with a row of five or six similar granules on the third interspace, becoming larger posteriorly, each with a short stiff hair, with a few small granules lateral to it near the apex.

Male with body of similar size and proportions; front flattened on a semicircular area, with a distinct median carina produced to form a distinct, laterally compressed tooth one-third of the distance above the epistomal margin; slightly excavated at each side, rather coarsely and roughly punctured, pubescence inconspicuous; pronotum more broadly rounded in front; elytra more narrowly rounded behind; declivital armature not so coarse as in the female but similar.

Type—A female, Orono, Maine, Aug. 1, 1919, M. W. Blackman, collector; Lot No. M-122-a.

Host plant—*Picea rubens* Sarg.

This species is in some respects rather close to *P. pulchellus* Eichh. (*hirticeps* Lec.) and is very similar in general appearance. It may, however, be readily distinguished by the more narrowly rounded anterior margin of the pronotum, the more broadly rounded apex of the elytra, the lesser elevation of the suture on the declivity, but especially by the presence of the carina on the front of the head in both sexes and by the strongly developed frontal tooth in the male. It has been compared with LeConte's types of *hirticeps* and *pusio* both of which are believed to be synonyms of *pulchellus* and is distinctly different although closely allied.

This species is described from a series of eighteen specimens taken from their burrows in the bark of a small spruce about six feet high which had been cut the preceding spring. The burrows are started near the base of a smaller branch and are of the radiate type with longitudinal and diagonal egg galleries. Only the one lot of specimens was found in Maine. Additional specimens were also taken from red spruce June 15 and 28, 1921, at Cranberry Lake, N. Y., by Blackman and Fivaz.

Cryphalus mainensis n. sp.

Description of the adult female: Black; 1.63 mm. long, 2.23 times as long as wide.

Front of the head convex, shallowly, transversely impressed between the eyes; surface sub-opaque, closely and roughly but not coarsely punctured, with a few fine short hairs; epistomal margin with a few short hairs, slightly emarginate and feebly elevated in the median line. *Eyes* finely granulate, the anterior line weakly emarginate. *Antenna* lighter in color; club twice as long as funicle, apparently with four sutures, of which all but the distal one (which is the least distinct) are nearly straight.

Pronotum 1.35 times as wide as long; widest posteriorly, sides arcuately rounded to the front, which is rather narrow; front margin with from three to seven serrations varying in size and arrangement but never with the first pair on each side contiguous as in *balsameus*; those on each side of the median line usually separated by a considerable space which is occasionally occupied by a small median serration; asperities rather sparse, irregularly distributed, occasionally several are contiguous or coalescent at their bases, asperate area concolorous; sides and rear of pronotum finely and densely granulate-punctate; pubescence shorter than in *balsameus*.

Elytra very slightly wider than prothorax 1.52 times as long as wide, nearly two and one-third times as long as thorax; sides subparallel, moderately rounded behind as viewed from above; distinctly punctate-striate, the punctures being more evident and the striae much more impressed than in *balsameus* and evident throughout their length; interspaces very finely and densely punctured with numerous scale-like hairs and a median row of slender hairs in each interspace which are coarser and longer at the sides; hairs from the striae punctures very fine and short.

The *male* is usually smaller than the female and can be distinguished by the more narrowly rounded elytra.

Type—A female, Orono, Maine, July 17, 1919, M. W. Blackman, collector; Lot No. M-98.

Additional Localities Loon Lake, Chamberlin Lake, Me., Cranberry Lake, N. Y.

Host Trees—Red spruce (*Picea rubens* Sarg.) white spruce (*Picea canadensis* (Mill.) B. S. and P.

This species is very similar in general appearance to *C. balsameus* Hopk. and is found in the same localities where the latter is abundant. It is readily distinguished, however, not only by its hosts but also by the character of the *frons*, the smaller and differently arranged pronotal serrations, the more strongly punctured and impressed elytral striae, the more evident hairs on the elytral disc and by other differences. It is distinguished from *C. rubensis* Hopk. by the slightly smaller size, darker color, the absence of the carinal line on the *frons* and the difference in the serrations of the pronotal margin.

The type series consists of several hundred specimens taken by the writer in Maine during the summer of 1919, a short series from Cranberry Lake, N. Y., taken June 15, 1920, by Professor C. J. Drake and Mr. A. E. Fivaz from limbs of red spruce, and numerous specimens from the same locality taken by Blackman and Fivaz during the summer of 1921.

The brood burrows are usually of the "cave" type similar to those of *C. balsameus*. However, several burrows containing several definite branch-galleries were found and in such cases the eggs were usually deposited in a small heap at the blind end of the gallery and covered with frass. In one case they had been

placed in definite egg-niches in the sides of a gallery. The usual type of burrow consists of an irregular cavity in the inner bark and outer sapwood. The eggs are laid in an irregular mass at any place in this cavity and are covered with the sawdust-like frass which often fills nearly the entire chamber. After laying their eggs the adults will often leave their burrow, usually by burrowing a second opening up through the bark. Several such deserted burrows were found where the eggs were still unhatched. The burrows are most commonly, but by no means invariably, started at the base of a smaller twig.

Other species of bark beetles associated with *C. mainensis* in the same limbs and twigs include *Polygraphus rufipennis* Kirby, *Pityophthorus puberulus* Lec., *P. dentifrons* n. sp., *P. shepardi* n. sp., *P. opaculus* Lec. and *Xylechinus americanus* n. sp.

PLATE VI

New Maine Ipidae from original photographs by Hammond.

All magnified about 14 diameters.

- Fig. 1, 2. *Xylechinus americanus* n. sp.
Fig. 3. *Pityophthorus balsameus* n. sp., ♀.
Fig. 4. *Pityophthorus balsameus* n. sp., ♂.
Fig. 5. *Oryphalus nainensis* n. sp.
Fig. 6. *Pityophthorus biovalis* n. sp.
Fig. 7. *Pityophthorus patchi* n. sp.
Fig. 8. *Pityophthorus shepardi* n. sp.
Fig. 9. *Pityophthorus dentifrons* n. sp.

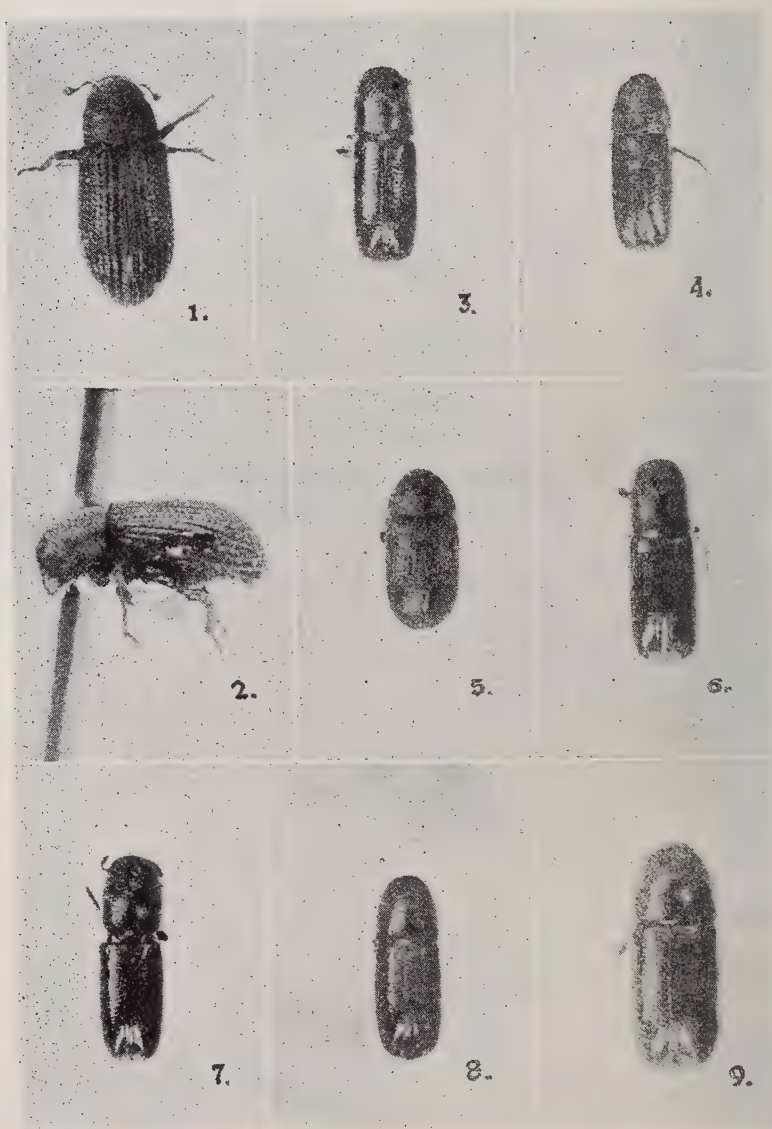


Plate VI.

PLATE VII

From original photographs by Hammond.

- Fig. 10, 11. Brood burrows of *Xylechinus americanus* n. sp. in the bark of white spruce.
Fig. 12. Brood burrows of *Cryphalus mainensis* n. sp. in bark of spruce.
Fig. 13. Brood burrows of *Pityophthorus dentifrons* n. sp. in the bark of white spruce.
Fig. 14. Brood burrows of *Pityophthorus shepardi* n. sp. in the bark of spruce.

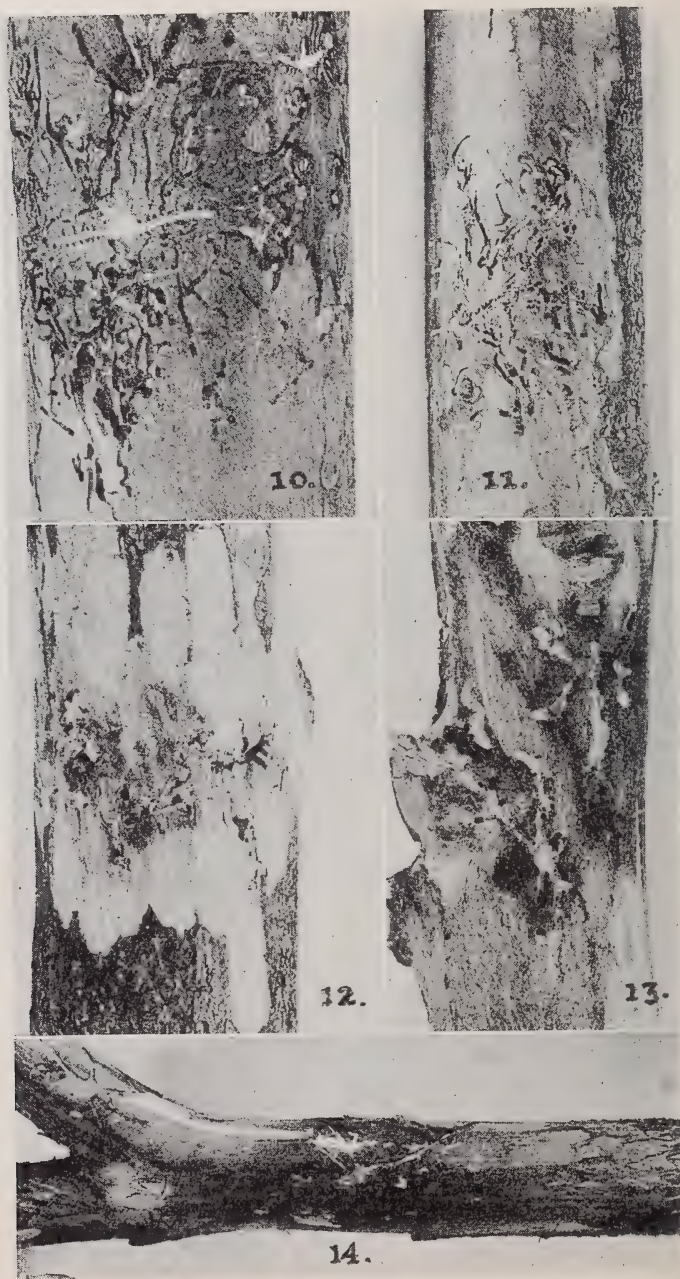


Plate VII.

PLATE VIII

Drawings by Paul W. Stickel.

- Fig. 15. *Xylechinus americanus* n. sp. dorsal view.
- Fig. 16. Front view of *X. americanus* n. sp.
- Fig. 17. Dorsal view of *Pityophthorus balsameus* n. sp.
- Fig. 18. Front view of male *P. balsameus* n. sp.
- Fig. 19. Front view of female *P. balsameus* n. sp.

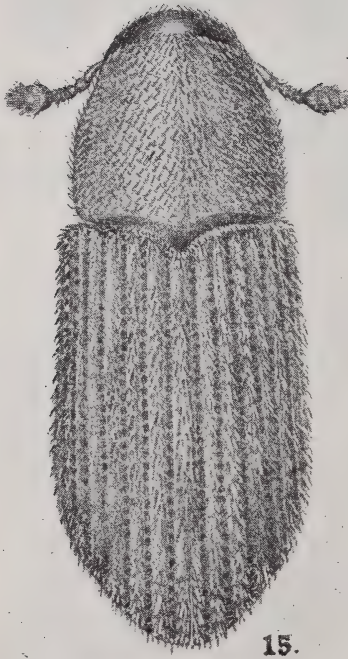
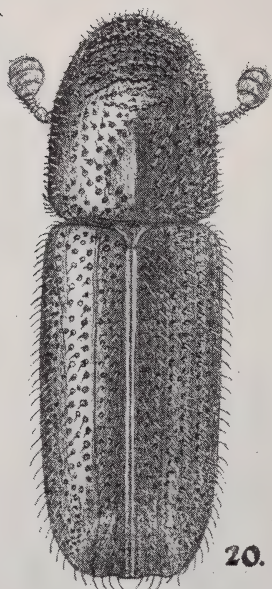


Plate VIII.

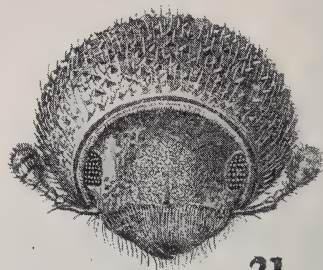
PLATE IX

Figures 20, 21 and 24 from drawings by A. F. Hough, figures 22 and 23 from drawings by Paul W. Stickel.

- Fig. 20. Dorsal view of *Pityophthorus patchi* n. sp.
- Fig. 21. Front view of *P. patchi* n. sp.
- Fig. 22. Dorsal view of *Pityophthorus dentifrons* n. sp.
- Fig. 23. Front view of *P. dentifrons* n. sp.
- Fig. 24. Dorsal view of *Pityophthorus shepardi* n. sp.



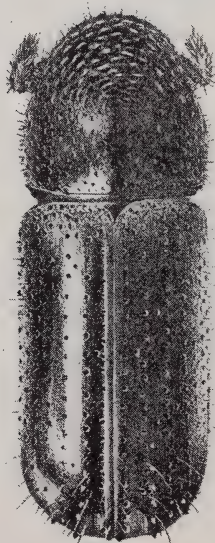
20.



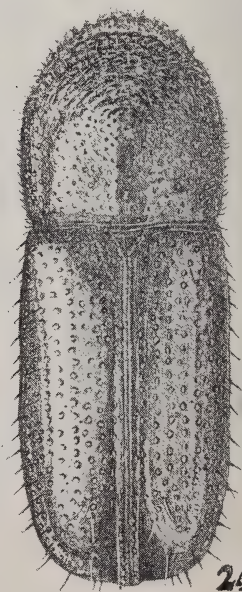
21.



23.



22.



24.

TWO NEW BARK-BEETLES FROM COLORADO*

By M. W. BLACKMAN, Professor of Forest Entomology, New York State College of Forestry, Syracuse, N. Y.

Ips guildi n. sp.

Description of the adult female: Reddish brown to black in color; 2.7 mm. to 3.5 mm. long (type 3.37 mm.), 2.88 times as long as wide.

Front of the head (Plate X, fig. 2) is flattened below, granulate-punctate, with the epistoma widely and deeply emarginate, and bordered with yellow hairs, which are more numerous near the median line; convex above, densely, coarsely, rugosely punctured, with an impunctate elevated median carina, hairs rather short and sparse; the *eyes* are coarsely granulate, with the inner line broadly and shallowly emarginate; the *antennae* are much lighter in color, the club with the first suture straight at center, recurved, at the sides, second suture bisinuate.

The *pronotum* (Plate X, fig. 1) is 1.17 times as long as wide, with the posterior angles broadly rounded, the sides subparallel to a point well in front of the summit, broadly rounded in front; the anterior area densely and coarsely asperate, transversely depressed and densely granulate just behind the summit except in the median line, which is slightly elevated, smooth, shining and impunctate; the rest of the disc, shining, sparsely punctured, the sides with coarser, more numerous punctures. Vestiture confined to the asperate area, sides and depressions behind the summit; wanting on most of the disc.

The *elytra* (Plate X, fig. 1) are slightly wider than the thorax, 1.75 times as long as wide, with the sides parallel as far as the origin of the declivity, thence arcuately narrowed with the end truncate; striae impressed, strial punctures coarse, deep, closely placed; interspaces rather narrow, with fewer, finer punctures arranged uniserially and becoming larger near the declivity where both strial and interstrial punctures become somewhat confused. The *declivity* (Plate X, figs. 1, 3) is abrupt, nearly perpendicular, concave, with numerous coarse, deep punctures; the sutural interspace elevated; lateral margins prominent, each armed with three prominent, slender, conical, sharp, slightly incurved teeth; the first arising from the second interspace and directed caudad-mesad; the second longer, curved, from opposite the third interspace and directed similarly; followed by a ridge which usually bears two large tubercles (or blunt, low, rudimentary teeth), the first in the fourth, the second in the fifth interspace; the third tooth is slightly larger than the second, only slightly curved and

* Contribution No. 32 from the Department of Forest Entomology, New York State College of Forestry, Syracuse, N. Y.

directed caudad, distinctly separate from the ridge above and from the strongly elevated acute posterior margin of the declivity, which is often slightly crenate and occasionally somewhat emarginate at the center. Vestiture abundant and moderately long.

The *male* is similar but the frontal carina is usually lacking, the sculpture coarser and the declivital teeth are longer, coarser and more curved.

This species is allied to *I. latidens* Lec. and *I. longidens* Sw. being especially closely related to the latter. It is, however, readily distinguished by the presence of the carina and by the coarser sculpture on the frons; by the differently shaped pronotum with its coarser, more numerous asperities, and by the coarser, better developed declivital armature as well as by other characters given in the description.

Type—A female, Grand Lake, Colorado, March 4, 1921, E. R. Guild, collector; N. Y. S. Coll. For., Lot No. 1227.

The type series contains twenty-three specimens taken from their burrows in the bark of lodgepole pine (*Pinus murrayana* Elw.) near Grand Lake, Colorado, January 22 and March 4, 1921, by Mr. Eugene R. Guild, a former student, now a ranger in the National Park Service. The species is named in honor of Mr. Guild.

***Pityophthorus murrayanae* n. sp.**

Description of the adult female: Reddish brown in color; 2.2 mm. long, 3.14 times as long as wide.

Front of the head (Plate X, fig. 5) flattened on a semicircular area which is very finely and very densely punctured and ornamented with numerous very fine, very short hairs; epistomal margin thickened to form a lip which bears minute inconspicuous hairs; sides and upper part of frons more sparsely and coarsely punctured; *eyes* rather finely granulate, strongly emarginate; *antenna* pale yellow in color, the club oval, with the first two sutures straight and strongly chitinated, third suture arcuate and subparallel to the distal margin.

Pronotum 1.1 times as long as wide; with the posterior angles rounded, the sides subparallel behind, rather abruptly narrowed in front of the middle, broadly rounded in front; the anterior margin with broad, low serrations; the asperities of the anterior area rather broad and low; summit moderate; posterior area shallowly depressed just behind the summit, surface shining, moderately punctured, with a distinct slightly elevated impunctate median line. Lateral margin of pronotum rather sharp behind; ventral surface punctured except in the posterior lateral angle.

Elytra wider than the pronotum, nearly exactly twice as long as wide, with the sides subparallel, rounded behind the origin of the declivity and with the apex subacuminate; the surface shining; striae not impressed, the strial punctures of moderate size, rather closely arranged; the interspaces narrow, somewhat rugulose, with

the punctures nearly as large as those of the striae but very sparse. *Declivity* strongly sulcate with the punctures of striae 1 and 2, especially the latter, obsolescent; the suture rather wide and strongly elevated with a row of very fine granules; the sulcus smooth, sub-opaque, moderately wide and deep; the lateral elevations moderately high with a very few, very minute granules. The vestiture is scanty, the disc nearly glabrous, with short hairs at the sides and on the declivity.

Male about the same size and proportions as female but differs in that the front of the head is transversely impressed below, with a small tooth just above the epistomal margin; the frons above strongly convex with a transverse carina between the eyes, which is angled at the center and there joined by a short median carina extending from above; all of frons except carinae densely punctured, nearly devoid of hairs. The elytra are widest at the base with the sides weakly converging behind, the declivity more deeply sulcate, with the suture and lateral elevations more strongly granulate.

Type — A female, Grand Lake, Colorado, December 30, 1920, E. R. Guild, collector; N. Y. S. C. F., Lot No. 1214.

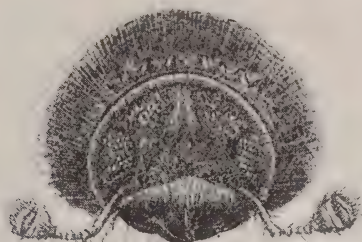
Described from a series of twenty-five specimens collected from the bark of the trunk of dying lodgepole pine trees near Grand Lake, Colorado, December 30, 1920, January 22 and February 18, 1921, by Mr. E. R. Guild, of the National Park Service.

PLATE 10

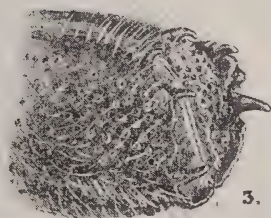
- Fig. 1. *Ips. guildi* n. sp. x. 21 dia.
Fig. 2. *Ips guildi* n. sp., Front view.
Fig. 3. *Ips guildi* n. sp. Posterior-lateral view of declivity.
Fig. 4. *Pityophthorus murrayanae* n. sp. x 18 dia.
Fig. 5. *Pityophthorus murrayanae* n. sp. Front view of the female.



1.



2.



3.



5.

A.R. Janson



4.

DESCRIPTION OF HYLOCURUS PARKINSONIAE N. SP.

With Revisional Notes on *Hylocurus* Eichh. and *Micrais* Lec.

By M. W. BLACKMAN

Description of the adult male: Dark reddish-brown in color, 2.17 to 2.4 mm. long, about 2.5 times as long as wide.

The *front* of the head is convex-above, opaque, densely and coarsely granulate-punctate with numerous (often abraded), clavate, cinereous bristles, directed anteriorly; with an arcuate, transverse, granulate carina separating the lower portion, which latter is transversely impressed, smoother, subopaque, with slightly longer, more slender hairs directed diagonally downward. The *eyes* are short oval, moderately coarsely granulate, with the inner margin entire. The *antennal* scape is short, clubshaped, curved or twisted, with a few rather short hairs; the funicle 6-jointed, $1\frac{3}{5}$ times as long as the scape, the pedicel wide, comprising more than $\frac{1}{3}$ of length of funicle, distal segments slightly wider; the club short oval, first segment about $\frac{1}{3}$ length of club, first suture very faintly sinuate, second similar and nearly parallel.

The *pronotum* is 1.03 times as long as wide, widest behind the middle, with the sides behind subparallel; moderately rounded in front; anterior margin with low blunt serrations; asperities of the anterior area low, broad, moderately coarse; posterior area reticulate, subopaque, granulate-punctate, with very short, fine hairs.

The *elytra* are wider than the pronotum; 1.5 times as long as wide, with the sides subparallel (slightly widened posteriorly), abruptly narrowed at the declivity, with a prominent sutural apex; surface rather feebly shining, nearly glabrous; punctate striate, with the striae deeply impressed posteriorly, with the punctures moderately coarse anteriorly but progressively coarser toward the declivital summit; interspaces narrower, with only a few punctures, shining anteriorly, subopaque near declivity, feebly convex anteriorly, but becoming carinate posteriorly and each ending at the declivital margin in a short, blunt tooth-like projection. *Declivity* abrupt, oblique, the face convex, striae punctured, the punctures coarse near the margin but rapidly becoming finer toward the apex; suture elevated, granulate, with short, stiff hairs, second and alternate interspaces flat, unarmed, with a few hairs only near declivital margin; third and alternate interspaces, more or less elevated, each with a few stiff hairs, third with from two to five small teeth or acute granules; fifth and seventh with one or more, ninth with the carina extending as far back as the base of the sutural apex, and, as seen from above, separated from this by a distinct notch.

The *fore tibia* is slightly wider toward the distal end, with the two sides sinuate; anterior edge with a few weak serrations; terminal mucro long, curved at the end; distal end obliquely truncate, armed with three submarginal teeth.

The *females* vary from 1.7 mm. to 2.3 mm. (allotype, 2.1 mm.) long, 2.6 times as long as wide. The front is slightly more flattened than in the male, very finely granulate-punctate, the transverse carina lacking, with the pubescence similar and lacking or nearly so in a transverse line corresponding in position to the male carina; the *pronotum* is similar to that of male but with the marginal teeth smaller; the *elytra* are proportionately longer than in the male, slightly wider than pronotum, with the sides subparallel as far as declivity, then broadly rounded, and ending in the acute sutural apex; surface moderately shining, striae with punctures finer than in male, interstrial punctures and hairs more numerous, both more abundant and the hairs longer toward the declivity, the interspaces not becoming carinate posteriorly; *declivity* with the margin rounded and the face convex, the suture elevated, granulate and setose, second interspace, flat, unarmed, narrowed posteriorly, third, fifth and seventh elevated, each with several acute granules, ninth subcarinate but not sufficiently so to be visible from above.

Type—A male, ex dead *Parkinsonia*; Ray, Arizona, E. A. Schwarz, collector. Allotype, a female, same labels.

Described from a long series of specimens collected by E. A. Schwarz at Ray, Arizona, and by Hubbard and Schwarz at Fort Yuma, Arizona, all of them being obtained from dead *Parkinsonia* sp. Type, allotype and numerous paratypes in the National Museum, paratypes in the author's collection.

Specimens of this new species were given to the writer for description by Dr. E. A. Schwarz with the comment that they represented a new species of *Hylocurus* and that in his opinion LeConte's genus *Micracis* should probably be submerged in Eichhoff's *Hylocurus*. The literature was examined with the following results: The genus *Hylocurus* was described by Eichhoff* in 1871 (pp. 133, 134) to include a single species from Mexico—*Hylocurus elegans*. The same author later (1879,† pp. 298–301) described the genus more fully and added descriptions of two new species—*H. discifer* from Venezuela and *H. alienus* from Cuba. The revised description (l. c. p. 298) reads as follows:

“Head globular, retracted, mentum oblong, narrow toward the base, ligula small, mentum inserted near apex. * * * Antennal funicle 6-jointed, 1st joint globose, thick, 2nd much narrower, the following transverse, becoming progressively wider, club subglobose, compact. Tibia sublinear. Tarsal joints 1, 2, 3 equal.”

* Eichhoff, W., 1871, Neue exotische Tomiciden —Arten. Berl. Ent. Leitschr, Vol. 15, pp. 131–137.

† Eichhoff, W., 1879, Ratio Tomicinorum, Brussels.

In 1895 Blandford* (pp. 220-225) redescribes the genus and adds seven new species from Mexico and Guatemala. His generic description is fuller and more definite and differs also in his recognition of the sexual differences. The essential portions of his description follows: "The antennae have a rather short, curved, clubbed scape, a six-jointed funiculus, the joints of which are moniliform, the third to the sixth transverse and increasing moderately in thickness; the club is short-oval, compact, and shining, crossed by two curved, fringed sutures. The tibiae are narrow, slightly wider apically, the anterior pair unarmed, except for two short spines at the upper apical angle. The elytra are more or less strongly punctate-striate, the punctures often much dilated and cribriform posteriorly; at the apex they are produced into a common mucro, as in *Micracis*. The sexual differences in their structure are important and were not recognized by Eichhoff. In the male the interstices become subcarinate as they approach the declivity, round which they form a marginal series of short teeth, carinae, or, in one species, acute spines, and they may be elevated above the general surface so that the sides of the elytra appear to diverge behind; the declivity itself may be convex or retuse and nearly vertical, elevated near the suture alone, and it may be sculptured differently from the horizontal portion. In the female the elytra are regularly and strongly declivous behind the declivity being convex, with no marginal tubercles round its upper border."

In his characterization of the genus Hagedorn† (1910, pp. 118-119) describes the eye as elliptical with the anterior margin emarginate, and the antennal club as solid, without sutures.

It is thus apparent that the characterizations of the genus *Hylocurus* Eichh. contained several ambiguities and discrepancies. This is especially true of the descriptions of the antennal club which Eichhoff describes as "Solida" which might be translated as "solid" (presumably without sutures) or merely as "compact." His figure, however, shows two distinct sutures and Hagedorn is manifestly wrong in describing it as "solid, without sutures." As has been shown recently by the writer,‡ the structure of the antennae and the foretibiae are of the greatest importance in determining the genera and species of this group. On the basis of such differences especially, the North American species included by LeConte in his genus, *Micracis* were divided into three groups of at least sub-generic grade: *Micracis* represented by *M. suturalis* and its allies; *Pseudomicracis* represented by *M. opacicollis* Lec. and *M. nanula* Lec.; and *Micracisoides* represented by

* Blandford, W. F. H., 1895, Family Scolytidae, Biologia Cent. Amer., Col., Vol. IV pt. 6, pp. 81-298.

† Hagedorn, M., 1910, Genera Insectorum, Coleopt., Family Ipidae, pp. 1-178, 14 pl.

‡ Blackman, M. W., 1921, North American Ipidae of the Subfamily Micracinae, Miss. Agr. Exp. Stat., Tech. Bull., No. 9.

M. rudis Lec. and its allies. It is now believed that the latter group is more closely allied to the described species of *Hylocurus* than to the true *Micracis* of LeConte of which *M. suturalis* Lec. is the genotype. Thus in the writer's opinion the genus *Micracis* Lec., represented by *M. hirtellus* Lec., *M. suturalis* Lec., *M. meridianus* Blackm., *M. populi* Sw. and *M. swaini* Blackm. and by *M. opacicollis* Lec. and *M. nanula* Lec. of the subgenus *Pseudomicracis*, should stand.

Hylocurus Eichh. then should include not only the species of that genus described by Eichhoff and by Blandford but also *H. parkinsoniae* described herewith, and the following species hitherto included with *Micracis*—*rudis* Lec. *biorbis* Blackm., *bicornus* Blackm., *harnedi* Blackm., and *langstoni* Blackm. These species agree with Blandford's redescription of the genus in all respects except in the extreme differences between the sexes. Even in this respect *langstoni* shows similar secondary sexual characters but these are not developed to such an extraordinary degree. In *harnedi* the sexual differences consist especially in the arrangement and size of certain teeth upon the declivity and in the greater elevation of the ninth interspace in the male. In *rudis*, *biorbis* and *bicornus* the sexes can be best distinguished by frontal characters, but are also indicated by the slightly coarser sculpture and the greater elevation of the ninth interspace in the males.

The arrangement then of this division of the subfamily should be as follows:

- A. Antennal club with distinct sutures on the outer face, scape clavate or flattened and subtriangular, funicle 6-jointed.
- B. Posterior end of elytra drawn out to form an acuminate sutural apex.
- C. Antennal scape club-shaped, with a few short or moderate hairs, antennal club with first suture broadly curved; eyes short oval, widely separated above and beneath; fore tibiae slightly wider distally, with both edges sinuate, outer edge weakly serrate, distal end with 2-4 marginal teeth.

Genus *Hylocurus* Eichhoff

- CC. Antennal scape flattened, subtriangular, with numerous long hairs, club with first suture angulate or narrowly curved, eyes large, elongate, more coarsely granulate, contiguous, narrowly or moderately separated beneath; fore tibiae with outer edge nearly straight.

Genus *Micracis* Le Conte

- D. Eyes moderately separated beneath, inner margin entire; fore tibiae with sides subparallel, both nearly straight, outer edge entire, terminal mucro wide and large.

Sub genus *Micracis*

- DD. Eyes contiguous or very narrowly separated beneath, inner margin emarginate; fore tibiae with inner edge sinuate, outer edge nearly straight, terminal mucro more slender.

Sub genus *Pseudomicracis*

- BB. Posterior end of elytra conjointly rounded without sutural apex. (The remainder of the subfamily arranged as in the Key on p. 7, Miss. Agri. Exper. Sta., Tech. Bull., No. 9.)

EXPLANATION OF PLATE XI

Fig. 1. *Hylocurus parkinsoniae* n. sp. male.

Fig. 2. *Hylocurus parkinsoniae* n. sp. female.

Fig. 3. Front view of male of *H. parkinsoniae* n. sp.

Fig. 4. Posterior view of elytral declivity of the male of *H. parkinsoniae*
n. sp.

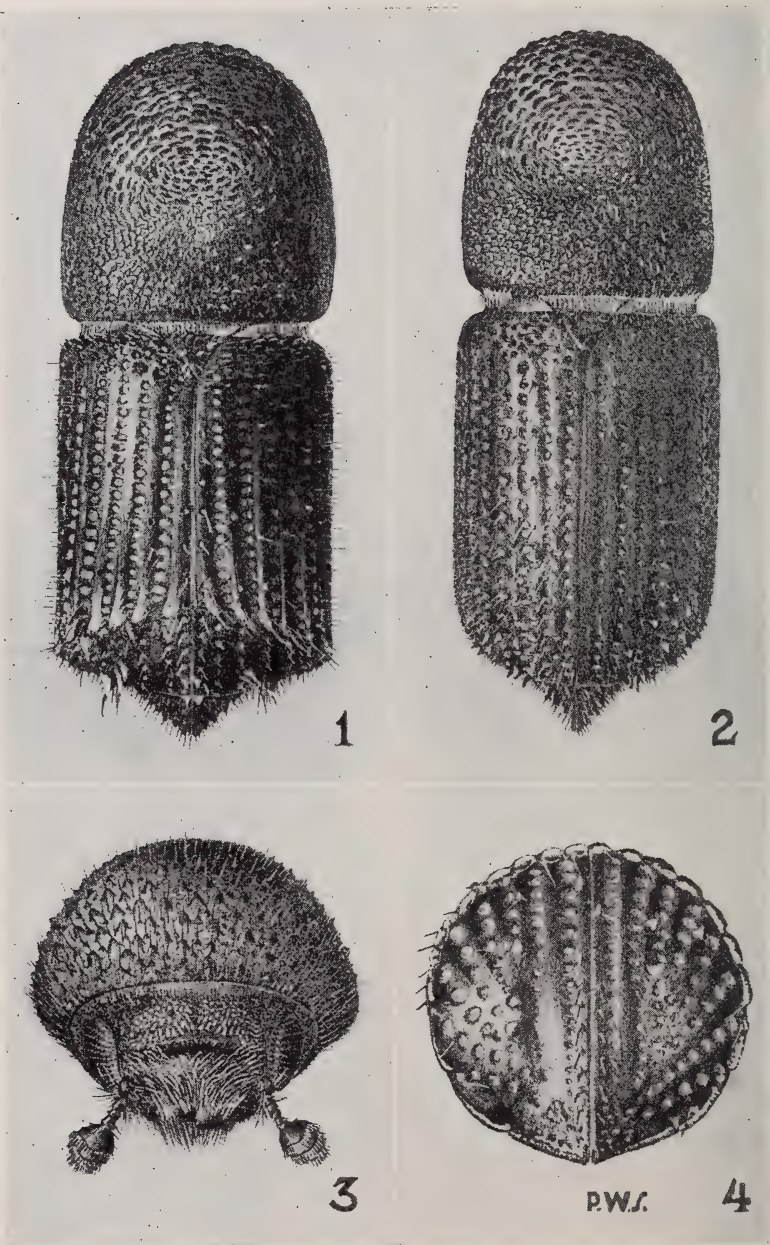


Plate XI.

THE LIFE HISTORY OF TWO SPECIES OF NABIDAE (HEMIP. HETEROP.)

Nabis roseipennis Reut. and *Nabis rufusculus* Reut.

BY F. G. MUNDINGER

The Nabidae as a group are wandering herb-inhabiting species spending most of their time on grass and low bushes. They are small in size, ranging from about six to ten millimeters in length. The general color is reddish-brown except for two species *Pagasa fusca* Stein and *Nabis subcoleoptratus* Kirby, which are black. The body is elongate-oval in shape and the legs are long and well adapted for walking. The proboscis is long and pointed and when not in use extends back between the prothoracic coxae. The eyes are coarsely granulated, bulging and located dorso-laterally on the sides of the head. The general attitude assumed by the members of this family, with the head slightly raised, the suggestively eager way of carrying the beak and the protruding apparently all-seeing eyes, gives them a most alert and war-like appearance.

The species most commonly found with *Nabis roseipennis* Reut. and *Nabis rufusculus* Reut. in the Cranberry Lake region are *Nabis limbatus* Dahlb and *Nabis fesus* Linn.

The eggs of only two species of this family have been described, namely, *Nabis fesus* and *Nabis rufusculus*. *Nabis roseipennis* because it is better illustrated is considered first in this paper, and *Nabis rufusculus* being very similar in both appearance and habits is treated with reference to the former but follows in a separate discussion.

ECONOMIC IMPORTANCE

The economic value of the members of this family is as yet a matter of only rough estimate since the bionomics of but one species is so far known.

Dr. Osborn (1918), in his article on "The Meadow Plant Bug, *Miris dolabratus* Linn.," found *Nabis fesus* a species closely allied to *N. roseipennis* and *N. rufusculus*, to be a formidable enemy to this destructive plant bug. In their work on the "Corn-ear worm" Garman and Jewett (1907) found *Nabis* (*Coriscus*) *ferus* to prey also upon this larva infesting the corn plant. *N. rufusculus* has been shown by Brunner and Swenk (1907) to attack and kill the hessian fly which is a great pest in wheat fields. Woods (1915), in his paper on "Blueberry Insects in Maine," describes *N. rufusculus* as feeding on the many small insects which the blueberry harbors.

Aphids, plant bugs, leaf-hoppers, and many other small insects are found in quantities in grasses during the summer season. It has been found that some of them, probably most of them, are

injurious to stands of grass, oats, hay, etc. Hence, *N. roseipennis* and *N. rufusculus* feeding on such insects must be considered as economically important. The presence of nabids on plants is not entirely beneficial, for it is undoubtedly true that by their habits of oviposition they may, when present in great numbers, do some injury. However, it is more reasonable to believe that what slight harm is done in ovipositing in such material as grass-stalks is more than offset by their suppression of plant-feeding insects.

METHODS

The first specimens used in this experiment were collected on June 10th. They were all females and were captured by sweeping the grass with a strong net. At this early date no nymphs were found, so the mature nabids had in all probability hibernated over winter.

Six wooden boxes were filled with dirt, and small plants placed in them. In one box was placed a raspberry slip, in another a goldenrod stalk and in the remaining boxes, grass-stalks. These plants were all carefully examined to avoid using any material already containing eggs or harboring insects of any kind. Ordinary glass lantern globes were then fitted with fine wire-mesh removable tops and placed over the growing plants in the boxes.

The cages so prepared were placed in a long tray at one side of the insectary. This structure was screened but otherwise open on three sides, giving the plants practically the same conditions for growth which they had in their former habitat.

The first specimens collected were placed on the plants on June 10th. Every morning each plant was examined and the habits of the nabids observed. This was especially for the purpose of noting when the first eggs were laid so that a careful record of oviposition could be kept. Every second day about half a dozen aphids or other small insects were placed in each cage. By the thirteenth of June six cages were in operation, each containing one female, and two containing male and female.

On the sixteenth of June the females began to oviposit, and since the grass-stalks seemed most preferred, the other plants were discarded, grass-stalks replacing them. One raspberry slip also was found to contain many eggs and was set aside.

Because of the peculiar habit of the female in laying her eggs, it was often difficult to distinguish the eggs oviposited at a certain time from others laid in among them perhaps the next day. The most accurate way of keeping this data was by numbering the sides of the boxes and designating the eggs by their position on the stalk in relation to the number on the side of the box.

On the thirtieth of June the specimens were again changed to new plants, since the egg-laying period was drawing to a close and the grass-stalks were well filled with eggs. This allowed a closer study of the hatching eggs and also of the habits of the mature nabids, which still laid a few eggs.

On hatching, the small, white nymphs, barely visible to the naked eye, were collected from the plants by means of a camels-hair-brush and placed in petri dishes, one or two in a dish. Each receptacle had been cleaned and a raspberry leaf placed within. Upon the leaf a drop or two of water was put, and also food in the form of aphids—one large one or two small ones per nymph. Each dish was numbered according to the box from which the specimens were taken, and the date of hatching placed upon it. Besides this, each additional dish was marked by a separate letter, date of beginning and other data as above. There were times when many nymphs had to be placed in one dish because of their great numbers. Over fifty cages were in operation at one time.

Every day observations of each dish were taken and the dishes thoroughly cleaned and supplied with a fresh leaf, water and food. Two nymphs from each instar were placed in alcohol for future study. One was taken as near the beginning of the instar as possible, and the other as close to the end of the instar as possible. Careful records were made of dates of moulting. By these methods about twelve specimens were carried successfully through to the adult stage. A later chart will show the mortality during this time, but it must be remembered that this includes the specimens preserved throughout the various instars.

Nabis roseipennis

N. roseipennis, commonly known as one of the blond damsel bugs, was first described by Reuter in 1872. It belongs to the order *Hemiptera*, suborder *Heteroptera*, family *Nabidae* Costa, subfamily *Nabinae* Reuter and genus *Nabis* Latreille.

DISTRIBUTION

N. roseipennis is practically transcontinental in North America, occurring from British Columbia to Colorado and New Brunswick to Virginia. It has been reported from the following regions north of Mexico; Northern Canada, Western Canada, Ontario, Maine, New York, New Hampshire, Massachusetts, Connecticut, Pennsylvania, Delaware, New Jersey, District of Columbia, Ohio, Wisconsin, Iowa, Nebraska, Kansas and Colorado.

GENTILIA

For a proper understanding of some of the observations later recorded, some knowledge of the genitalia and ovipositors is necessary.

In the male, the last segment of the abdomen is hollowed-out at each side dorso-laterally and accommodates a clasper in each concavity. The clasper in general outline is spoon-shaped, as shown in Fig. 32, with the extreme ends bent slightly out of the same plane. It is fastened at the smaller posterior end and extends forward. A few hairs arise from this posterior portion. The

anterior end of the clasper is expanded into a thin, flat area, the upper margin of which terminates in a spine-like process.

The claspers of *N. roseipennis* compared with those of *N. rufusculus* show a considerable difference in shape. The form of clasper varies for each species of the family and has served as one of the specific characters of the species.

THE OVIPOSITOR

The ovipositor of the female is quite prominent and located on the postero-ventral side of the abdomen. The last segment has in its surface a wide groove, and it is in this that the folded ovipositor lies. It is cylindrical for about two-thirds its length, but at the extreme posterior third is expanded into a structure consisting of two closely approximated, spoon-shaped parts. The entire ovipositor is quite hairy, the longest hairs being on the posterior end.

On dissection, the external egg apparatus is seen to consist of six parts arranged in three pairs. The first or outermost pair forms an enclosing sheath and is translucent, the dark stylets showing through them as a long, brown streak, when they are closed. They are hollowed-out and slightly curved, the extreme posterior portion being spoon-shaped as stated above. The middle pair consists of two long, narrow stylets, brown in color and very hard and chitinous. They are also slightly curved and grooved to accommodate the third or innermost pair. These are a little shorter and heavier than the middle pair and their points are spirally-serrated. This third pair is also widely grooved and when placed in approximation forms a tube through which the egg passes and is placed in position in the stalk or leaf.

In Fig. 29 the second and third pairs are drawn as they are normally fitted into one another. In Fig. 30, the ovipositor of *N. rufusculus*, these parts are shown entirely separated and may be referred to for *N. roseipennis* because of the similarity.

Considerable force is used by the nabid in piercing a stem with the stylets and this led to a search for some supporting structures at the base of the ovipositors.

Just under the chitinous covering of the last abdominal segment was found what might be called a supporting or reinforcing structure. It consists of two pairs of arched chitinous bands connecting the base of the ovipositors with two other chitinous bands running posteriorly along the lateral edges of the last segment on each side and just inside the connexivium. From the middle point of each side of the sheath of the ovipositors a band is given off perpendicularly to the sheath and curving over the abdomen uniting with the lateral bands near the junction of the first two and their union with the lateral bands. There is also a third band, a continuation of the anterior ends of the lateral bands, which arches over the segment just anterior to the bases of the ovipositors. This band completes the several structures of the region.

OVIPOSITION

Oviposition might be explained theoretically as follows: With the bending-under of the abdomen the muscles locking the sheath are relaxed, allowing its two sides to spring apart. At the same time the ovipositors are let down and perhaps the initial piercing done by the longer stylets. The innermost pair probably does most of the rasping and drilling after the surface is ruptured, using the second pair as a sleeve through which they are able to operate up and down. The longer stylets also may aid in spreading the opening during the passage of the egg and the withdrawal of the innermost pair. The two spoon-shaped structures of the first pair probably aid as egg guides.

Oviposition is an interesting phenomenon to watch. The first part of the process seems to be that of testing the grass-stalk at various places with the proboscis. If a nabid has oviposited at a particular spot on a stem, she is quite sure to return to the same vicinity a second or a third time.

On June 17th a nabid was seen near the top of a grass-stalk probing it with her proboscis. After a short time this was stopped and the abdomen bent forward and under. The first two pairs of legs were holding firmly to the opposite side of the grass-stalk. Almost immediately the ovipositors were seen to swing downward slowly. This motion was so slow and steady as to remind one of the mechanical manipulation of a heavy piece of steel. The ends of the stylets touched the grass-stalk near where the proboscis had been. They were at first perpendicular to the stalk. There was an apparent straining and a rhythmic jabbing motion of the abdomen. The female seemed to exert every ounce of her effort to pierce the outer grass wall. Sometimes with all the straining she was unable to force her stylets in, then again after only a short trial they would suddenly sink into the stem for their entire length. They appeared to be guided somewhat by the female after breaking through the hard exterior of the stalk.

Several of these operations were timed. Once the ovipositor was found to remain inserted for three minutes and ten seconds, another time for three minutes and thirty-five seconds, and a third time for only thirty seconds. On the withdrawal of this egg-apparatus nothing can be seen until after a few hours. The plant tissues gradually shrink away from around the distal end of the egg revealing the little egg-caps.

There were cases in which nabids had oviposited through thin blades of grass, the eggs extending entirely through and hanging merely by means of the enlarged egg-caps. Some eggs were inserted similarly, but with the distal end down. These eggs so exposed to the air, did not seem to shrivel or lose their smooth outline.

The females were found to lay from fifteen to sixty-five eggs each, and to have a laying period of about eighteen days. Since these specimens may already have been laying before they were captured, the figures in this respect are merely tentative.

THE EGG

The egg of *N. roseipennis* is about 1.78 mm. long and of a glistening blueish-white color. It is elongate-oval in shape and slightly curved toward the distal end, where there is a feeble constriction. Beyond this portion it widens again to receive the white hood. This hood is very distinctive and serves easily to distinguish the egg from that of *N. rufusculus*.

The incubation period varies from seventeen to nineteen days. At the end of this period the hood is loosened by some force within the egg and the nymph gradually and very slowly emerges. The whole phenomenon has much the appearance of growth as there seems to be no movement on the part of the nymph at first. The head is first seen pressing against the hood and pushing it along for a few seconds. As the nymph emerges further the hood slides off from the head and falls at the side of the egg-shell, but still attached by a thin filament.

The head of the emerging nymph is bent slightly ventrad, the antennae, proboscis and legs being in close approximation, making the whole mass appear quite compact. It is shining and nearly colorless except for the brown bead-like eyes. When the nymph has emerged far enough so that the prothoracic legs are free, they are feebly used in drawing out the rest of the body. This is true for each pair of legs. The nymph finally emerges and stands near the empty shell, still having the abdomen attached to the filament holding the egg-cap, by a slender thread-like substance. This is soon broken and the nymph seems to remain motionless for a very short time. This is doubtless done to allow the chitin to harden, since in many instances the legs are not at all able to support the weight of the nymph when first hatched. The period of rest is, however, a very short one and soon the young nymph is scampering off for food and drink.

After hatching, all that can be seen of the egg-shell is the somewhat irregularly-shaped opening about level with the surface of the grass-stalk and the hood lying at one side attached by the bent filament. Drawings of the egg before incubation and after, are shown in Figs. 9, 10, 11 and 12.

FIRST INSTAR

The nymphs on first hatching are about 1.4 mm. long and nearly colorless, becoming whitish after a short time. The nymph as seen from above is bluntly pointed at each end; proboscis very long, reaching beyond metathoracic coxae; legs transparent and lengthened out of proportion to body; tarsi with proximal segment very short and distal segment much longer; each division of thorax with four hairs on dorsal surface, two near the center of the segment and one near each lateral edge; prothorax with median furrow; meso- and metathorax depressed below the level of the prothorax and abdomen, most strongly depressed medially; abdomen strongly

arched, the segments easily determined, each bearing four hairs similar in arrangement to those on the thorax, the outermost row arising from spiracles along the margins, the sixth segment having the largest spiracles and the longest hairs; three large light spots on central dorsum of segments three, four and five respectively; eyes large, semi-circular in outline as seen from the side, coarsely granulated, and reddish brown in color; two prominent hairs on dorsum of head above eyes; antennae about twice as long as body, hairy, the segments being longer successively as they approach the distal end; base of antennae dark, dark streak extending nearly to eye; first antennal segment with dark streak beneath and black ring at distal end; prothoracic femora well-developed, with row of teeth along inner side, each giving rise to a hair-like bristle, and a similar row on ventral side, also dark subapical spots; mesothoracic femora hairy and with dusky, subapical spots; metathoracic femora with six long hairs along inner side and red apical ring; all tibia hairy; tarsi with thin covering of hairs and darkened at outer end.

As the nymphs grow older the body becomes yellowish-white in color, also the legs; brownish streaks appear on disc of thorax near lateral margins; lateral edges of abdomen become compressed; central area, brownish; third segment pigmented and well-defined at edges.

SECOND INSTAR

Length at beginning of second instar is about 2.58 mm., and form assuming more that of mature nabid; translucent to colorless at first; antennae a little longer than body; proboscis with dark central streak and extending beyond mesothoracic coxae; thoracic terga greenish in color and not extending to lateral margins; pleural region of thorax dusky, a white streak running between this region and the dorsal terga; ventral portion of abdomen becoming well rounded, lateral edges unpigmented and prominent; small black spots at bases of teeth on first and second femora.

At the end of the instar the streaks along dorsal margins of the thorax become brownish; central areas of second and third abdominal segments olive-green; third and fourth segments with patches of green; red spots on third segment and a few irregular dashes of red on central dorsum of segments three, four and five; dorsal terga of abdomen not reaching to lateral margins; spots noticeable on metathoracic tibia; terminal segment reddish.

THIRD INSTAR

Length of nymph about 2.87 mm.; body longer in proportion to width than in second instar; antennae about one-quarter longer than body; tylus dusky at sides; two distinct dusky lines appearing on dorsum of head; dusky design beginning on disc of prothorax; mid-dorsum of first and second abdominal segments with

small, greenish patches; third segment with large, green patch and central, red spot; last abdominal segment dusky; abdomen hairy on ventral side; pro- and mesothoracic femora with large, dark patches; small, stiff bristles appearing on ventral side of prothoracic femora; small teeth appearing on inner side of first tibia; metathoracic tibia well spotted.

At the end of the instar wingpads appear definitely outlined; margins of abdomen wide and whitish; triangular white spots at postero-lateral corners of each abdominal segment very noticeable; tarsi greenish at outer ends.

FOURTH INSTAR

Length about 4.7 mm.; antennae about as long as body, the two distal segments light greenish in color; two dark spots between hinder portions of eyes; greenish patch on each side of head posterior to eyes; black design on prothorax further developed and median red streak present; wingpads growing larger, tips of metathoracic pads reaching posterior of first abdominal segment, both pairs of wingpads, olive-green with a few white spots; median area of meso- and metathorax colorless; inverted "U" on dorsum of anterior end of abdomen and red spots at centers of first few segments; row of six round, greenish dots at under side of lateral edges; dusky bars beginning to form on outer sides of prothoracic femora.

At the end of the instar, sides of tylus are very dark; anterior dorsum of head dusky; red streak along posterior median line; red median line on thorax and red spot on center of each abdominal segment; tips of mesothoracic wingpads nearly equal in length to those of the metathorax; coarse hairs on venter of thorax and abdomen.

FIFTH INSTAR

Length about 4.87 mm.; body becoming proportionally broader than in the previous instar; proboscis reaching first coxae; antennae about as long as body; dark markings on head more conspicuous; design on disc of prothorax further developed and medial, red line present; mesothoracic wingpads grown so that the tips overlap about one-half on the fourth abdominal segment, longer and narrower than the metathoracic wingpads; abdominal margins well defined and slightly thickened; dusky "V" on dorsum and also light rectangular area; red dashes in a line along mid-dorsum of abdomen, posterior segment hairy; the many small bristles on under sides of pro- and mesothoracic femora longer and the teeth appear smaller in proportion than before.

At the end of the instar the design on the thorax is completed; head dusky on ventral side; large spine forming on prosternum; center of mesothoracic disc with red design; each segment of abdomen except the last two with long, red dashes at extreme lateral edges; two red spots on head behind eyes; row of green

patches along sides of abdomen below lateral edges; ovipositor of female in process of formation; mesothoracic femora becoming barred and tibia quite heavily spotted; beginning of suture outlining inner edge of clavus; distal segment of tarsi beginning to divide into two parts.

HABITS OF NYMPHS

The habits of the young nymphs were quite interesting to observe. As soon as their legs were strong enough to support their weight, they were off on their quest for food. The usual behavior when there was no food in sight was to amble along slowly over the surface of a leaf or stem, prodding at it with the proboscis.

The predaceous character of the family is revealed very early in the life of the young nymph. One-day-old nymphs were seen attacking aphids twice their size, thrusting the sharp proboscis with great precision into the abdomens of their victims. Sometimes the aphid in an attempt to escape would pull the nabid along bodily for a short distance, finally freeing itself. Very seldom did all the nymphs placed in one dish reach maturity. It was usually a hard-fought contest, with the most aggressive subduing and eating the others. In feeding, the prey was pierced in various places and the body juices sucked out. Even the coloring-matter of the eyes was extracted and usually when a nymph was through feeding the body of its victim collapsed. The completeness with which this extraction is done is remarkable.

The nymphs were hearty eaters, especially the younger ones, which fed almost continuously. They were also fond of water, one nymph having been observed with its proboscis inserted in a drop of water for four minutes and apparently drinking. When teased with a needle or a straw, they would often accept the challenge to combat.

The small nabids were also seen frequently cleaning the proboscis and antennae. This was accomplished by drawing the structures between the approximated distal ends of the tibia. On close examination, these were found to have a row of spine-like hairs at their outer ends which serve as excellent scrapers or brushes in removing small patches of old moult-skin or other foreign particles.

MOULTING

A number of nymphs were observed in the process of moulting. This is an interesting phenomenon and takes place as the nymph stands on the upper side, or clings to the lower side of a leaf. Just before moulting as was stated, the nymph is usually sluggish in its actions, the abdomen becoming whitish, probably because of the expulsion of all faecal matter. The nymph assumes a position as shown in the drawing in Fig. 16, legs well spread apart, especially the metathoracic pair which appear braced. The head is bent downward so that the probosis is close to the ventral side

of the thorax along with the antennae. The skin breaks along the mid-dorsal line from the head to about the center of the abdomen. The body within is bowed upward and the prothorax is the first part seen to come through the slit, later the head is withdrawn. The legs are packed close together and by an up and down motion of these, much like a pumping action, the nymph climbs out of its old skin which remains standing.

A specimen was timed during the fourth moult, as follows: The skin split about 9:44 A. M. At 9:51 the proboscis and one antenna had been withdrawn; soon after that the other antenna; next a front leg was worked free and gradually all of them, and the nymph stood quietly bracing himself, his abdomen still attached to the moult-skin. This he finally separated himself from by pushing against it with his hind feet. At 9:58 A. M. the process was completed, just fourteen minutes after the dorsal split occurred.

Directly after moulting the movements of the head and legs were very feeble. At this time in the earlier instars the nymphs were nearly colorless except for red spots on the femora, antennae, and the reddish eyes. In the later instars, the first appearance after moulting was a dead-white, red spots appearing on the first and second antennal joints, on the head and also at the apical ends of the femora. The eyes have a reddish-brown appearance and the coxae are transparent and glass-like.

The spots first appearing red, usually turn black after a short time. One exception to this is the apical spot of the femora which sometimes remains a reddish-brown.

The nymph is not in its new covering long before it hardens and begins to color. That this pigment is merely in the outer skin is shown by a study of the old moult-skin, and that it is produced by cells underlying it is shown by the absence of color in the newly acquired skin.

THE ADULT

N. roseipennis is found in both the long-winged and short-winged form. Length of adult male about 5.9 mm.; widest part of prothorax 1.4 mm.; widest part of abdomen 1.9 mm.; color red-brown with dusky markings; general shape elongate-oval; female about 7.1 mm. long; widest part of prothorax 1.6 mm.; widest part of abdomen 2.3 mm.; female wider proportionally through abdomen than male, and with darker markings; antennae not quite as long as body, second joint dark at apical end and the two distal joints dark; eyes large, dark red and bulging; tylus dark along sides; dusky converging lines on head with dark, narrow area between them hairy, a large ocellus at the posterior end of each dark line; sides of head dusky and pubescent; wings light tan in color, pubescent and dusky-spotted; one unbranched vein through clavus; two long veins in corium, inner one dividing near posterior end of commissure and uniting again, forming a diamond-shaped cell, the vein then extending along the posterior border of the corium

giving-off branches through the membrane; row of inner closed cells and a row of outer, open cells formed in membrane; second vein extending through corium to outer, posterior border of this area and giving-off two branches about two-thirds of the way along; under side of the head dark and hairy; prothorax immediately before first coxae dark; mesothorax black below with fine pubescence; abdomen with dark streak along mid-ventral line; margin of abdomen slightly reflexed; a large spiracle surrounded by red on ventral side of each segment of the connexivium; abdomen hairy below; last segment of male blunt at end, its dorso-lateral sides hollowed-out to accommodate the claspers; terminal segment of female pointed at posterior end and hairy; fore-femora well developed, heavily spotted above and barred on outer side, many small stiff bristles below; tibia nearly colorless and with double row of black teeth along the inner edge; mesothoracic femora heavily barred on outer side, also heavily spotted and with small bristles below; tibia, with double row of black spines; metathoracic legs long, femora heavily spotted also, tibia heavily spotted; tarsi dark at each end and three-jointed.

HABITS OF MATURE NABIDS

The nabids seem most active on warm and sunny days, most of them having been captured at such times. The specimens used in this experiment were found in grass and low bushes where there was plenty of food.

Observed in the cages, their movements were usually slow, walking along probing the surface of the leaf with the proboscis. On being disturbed they could move away quickly, their long legs being well adapted for walking. Oftentimes they would remain quiet at some place on a leaf, but usually made a sudden dive if a small insect came within reach. They are greedy feeders and will reach for a second victim before the first is entirely consumed.

Two nabids were found copulating, their abdomens together and bodies extending in a straight line. During this time, which was probably toward the end of the period, the claspers of the male were seen to curl slightly and straighten-out again. This movement occurred along both axes. When copulation was completed, the male was seen to wave his claspers excitedly. No definite use for these structures could be ascertained.

There was no evidence of a second generation during that summer. The nymphs on maturing were placed in pairs in separate cages for observation. On the 17th of September a copulation was observed but the female was not seen ovipositing. It is therefore quite probable that the females hibernate over winter and oviposite in spring.

NATURAL ENEMIES

Perhaps the greatest natural check of this family and species, as of most other insects, is climate conditions. These affect the younger nymphs more readily than they do the older ones.

Moderate cold does not play such an important part as severe and sudden changes in temperature do. This may kill them or slow-up considerably the life processes.

The nymphs of the first instar are very delicate and readily subject to mechanical injury such as may occur during hard rain-storms, wind-storms and the like. A very small drop of rain will drown a nymph of the first or second instars.

Secondly, they are enemies of their own kind as was shown in the discussion of habits. This cannibalism extends throughout all stages, seemingly becoming greater as the nabid approaches maturity. There are other predaceous insects which very likely prey upon them—as certain reduviids and phymatids. Spiders and birds, too, are probably formidable enemies.

A parasite was observed on a nymph when the latter was about ready to moult the second time. It appeared in the form of a very small red sac hanging on the ventral side of the body. It grew larger every day and after the sixth day left the insect. It was probably because of the parasite that the nabid failed to moult, remaining fifteen days in the second instar. The average duration of this stage is about four days. Dr. H. E. Ewing of the Division of Insects, Washington, D. C., kindly identified the parasite as belonging to the family *Trombididae*, or "Harvest mites". Shannon (1914), in his paper, "Habits of Some Tachinidae," states that *N. roseipennis* is parasitized by *Leucostuma atra*.

Nabis rufusculus Reut.

Since *N. roseipennis* Reut. and *N. rufusculus* Reut. are so similar in a great many ways, the discussion in the first part of this paper dealing with the economic importance, methods of procedure, etc., for *N. roseipennis* may safely be applied to *N. rufusculus*.

CLASSIFICATION AND DISTRIBUTION

N. rufusculus was first described by Reuter in 1872. It belongs to the order *Hemiptera*, suborder *Heteroptera*, family *Nabidae* Costa and genus *Nabis* Latriele.

This species is also practically trancontinental in its range in North America, occurring from British Columbia to New Brunswick and Colorado to Virginia. It has been reported from the following regions: Ontario, Maine, Massachusetts, New York, Maryland, New Jersey, New Hampshire, Vermont, Connecticut, District of Columbia, Virginia, North Carolina, Colorado, Northern and Western Canada.

GENITALIA

The last segment of the male is concave at its dorso-lateral sides, very similar to that of *N. roseipennis*. A clasper extends across each one of these concavities (Fig. 33). Unlike the claspers of *N. roseipennis*, the anterior ends are much broader (Fig. 34) and

are semicircular in shape, terminating in a sharp spine, directed upward in normal position. The posterior portion of the clasper is much smaller than the anterior end and is slightly twisted out of the same plane. It bears a number of hairs on the upper surface.

The ovipositor of the female is very similar to that of *N. roseipennis* and the act of oviposition is very similar. The laying-period began about June 13th and extended to about July 9th. This also might be somewhat in error as some of the nabids probably had begun to lay before they were captured. *N. rufusculus* favored the grass-stalk as a place to oviposit, though this particular species is known to oviposit in certain fruits such as blueberries, as was shown by Woods (1915) in his paper on "Blueberry Insects in Maine."

THE EGG

The egg of *N. rufusculus* is about 1.4 mm. long, elongate-oval in shape and bent at the distal end much as that of *N. roseipennis*, though not quite so sharply (Figs. 5 and 8). It is whitish in color and glistening. The striking difference between the eggs of the two species besides shape is the covering at the distal end. In *N. rufusculus* it is a flat cap nearly circular in outline, and flanged, fitting into the egg much like the cover fits into a milk can (Figs. 6, 7).

The incubation period is between thirteen and eighteen days. The phenomenon of hatching is similar to that of *N. roseipennis*, the young nymph pushing the egg-cap ahead of it until this slips off the head and falls at the side of the cavity, still attached to the shell. This connection is made by means of a double filament, elbowed or bent in a similar manner to that of the other species (Fig. 7). The empty egg-shell appears as an irregular opening at the surface of the grass-stalk.

FIRST INSTAR

The nymphs on first hatching are about 1 mm. long, nearly colorless, becoming whitish after a short time. They resemble the nymphs of *N. roseipennis* very much. The nymph is bluntly pointed at each end; proboscis transparent and very long, reaching beyond metathoracic coxae; legs very long and transparent; coxae large, prominent and clear; distal segment of tarsi longer than proximal segment and dark at end; thorax with small median furrow on dorsum of first two segments, the anterior edge of the metathorax depressed below the level of the abdomen; each segment of thorax bearing four prominent hairs on dorsal surface similar to those of *N. roseipennis* in arrangement; abdomen arched, segments each with four hairs, those along margins arising from spiracles, the spiracle of the sixth segment being the largest and having the longest hair; abdomen with three large white spots on central dorsum of segments three, four and five, respectively; eyes large, semicircular in lateral outline and reddish-brown in color; two prominent hairs above each eye; antennae hairy and

about twice as long as body, segments longer successively toward distal end; dark streak along under side of first segment and black ring at distal end; second segment with narrow dark ring at distal end; dark streak from base of antenna extending toward eye; prothoracic femora large, whitish and hairy; row of small teeth along under side of femur and a row along the inner side, each giving rise to a bristle-like hair, dark subapical spots present; mesothoracic femora with long hairs below and a few above, small dark subapical spots present; metathoracic femora with dark subapical spots and reddish apical ring; all tibia whitish and with long hairs.

At the end of the instar the abdomen appears slightly elongated, rounded ventrally and the margins compressed dorso-ventrally; lateral edges of thoracic disc darkened; small, triangular, white areas at postero-lateral edge of each segment.

SECOND INSTAR

Length about 2.54 mm.; body longer proportionally than in first instar; antennae a little longer than body; thorax with faint brownish streaks along lateral edges of terga; abdomen robust, lateral edges compressed, forming definite margins; color brownish with two red spots on central tergal region of first abdominal segment; tergum of third segment definitely defined and with large greenish patches; terga of abdomen appear to be cut off near lateral edge; pro- and mesothoracic femora spotted; tarsi dark at ends.

At the end of the instar the streaks along lateral of thoracic disc appear heavier; pleura of thorax slightly dusky, leaving white streak between terga and pleura; two reddish spots on central-dorsum of first abdominal segment; green spots on segments three and four.

THIRD INSTAR

Length about 3.17 mm.; antennae about one-quarter longer than body; proboscis slightly darkened at base; wide clear streak mid-dorsally from head to first abdominal segment; margins of thoracic terga pigmented, also pleurae, greenish; posterior segments of abdomen dusky and quite hairy; legs whitish; coxae transparent.

At the end of the instar a red medial streak extends through anterior and posterior ends of abdomen; two reddish spots on dorsum of metathorax; last three segments of abdomen olive-brown; legs only moderately spotted; small bristles developing on under side of pro- and mesothoracic femora; double row of teeth developing along inner side of pro- and mesothoracic tibia; hind tibia spotted lightly.

FOURTH INSTAR

Length about 4.09 mm.; antennae a little longer than body; dark streaks along sides of tylus; two dusky streaks on dorsum of head; large olive patches on head behind eyes; beginning of characteristic design on prothorax; tips of mesothoracic wingpads

nearly even with those of the metathorax, their color dusky with a few white spots; pleurae of thorax dark-olive; dusky design with central, rectangular, clear area on dorsum of anterior abdomen; row of round, green spots on lateral sides of abdomen below margins; dark spots on fore-femora at bases of teeth; tibia with double row of black spines or teeth along inner side, hairy; mesothoracic femora with small, stiff bristles developing below and a few dark spots; metathoracic tibia lightly spotted.

At the end of the instar the dusky marks on dorsum of head are enlarged; characteristic design on prothorax, nearly completed; two large red spots on dorsum of first abdominal segment, also at lateral edges of third segment.

FIFTH INSTAR

Length about 5.12 mm.; nymphs with faint markings of ovipositors on abdomen appear longer than the others, which are probably the males of the species; body broader in proportion to length than in preceding instar; antennae about as long as body; sides of tylus brownish; large olive patches on sides of head behind eyes; black design on prothorax about completed; red streak running dorsally and medially just posterior to head and extending on prothorax; mesothoracic wingpads long and narrow, reaching to about one-half the fourth abdominal segment; metathoracic wingpads not grown beyond posterior edge of first abdominal segment; clear area on dorsum of abdomen surrounded by light olive and containing the three characteristic yellow-white spots; lateral margins of abdomen broad and compressed; red dashes through mid-dorsum of abdomen; pleura of thorax brownish; body whitish below; row of green patches along side of abdomen ventral to lateral edge; prothoracic femora well developed, the ventral row of teeth nearly disappearing; mesothoracic femora with few spots, small bristles below; metathoracic femora with few spots and reddish ring at apical end; tibia long and with very few spots.

Toward the end of the instar the broad abdominal margin is slightly reflexed; red design of indefinite shape on center of pro- and mesothorax; continuous red streak through mid-dorsum of abdomen; red dashes at extreme outer margin of segments, also small triangular white patches; red dashes along under side of lateral margins; apical joint of tarsus beginning to show signs of division into parts, forming a three-segmented tarsus.

THE ADULT

N. rufusculus is found in both the long and the short-winged form. The adult male nabid is about 5.7 mm. long; widest portion of thorax is 1.3 mm.; widest part of abdomen is 1.9 mm.; adult female nabid is about 6.5 mm. long; widest portion of thorax is about 1.4 mm.; widest part of abdomen, about 2.2 mm.; general shape elongate-oval; antennae a little shorter than body, second joint dark at apical end and outer two joints dark; general color tan with dusky markings; proboscis extends between prothoracic

coxae; dorsum of head tan colored and pubescent, two dark lines on dorsal surface with dark area between them; a large ocellus at posterior end of each of these lines; dark patch on head behind each eye; ventral of head and prothorax light, the latter pubescent above and forming collar for neck; characteristic design on raised area of disc, anterior and posterior lines deeply impressed; scutellum triangular in shape and with central, dark design; wings light tan, spotted with dusky; straight vein through clavus; two prominent veins through corium, inner one dividing, then uniting again, forming a diamond-shaped cell near the posterior end of the mid-dorsal commissure, the vein continuing along the posterior border of the corium and giving off long veins through the membrane, these forming a row of open cells at the posterior border; outer vein extending to outer posterior corner of corium and giving off two branches about one-half the way along; abdomen with narrow, dark, mid-ventral streak and broader streak along sides below lateral margin; lateral margins reflexed slightly, connexivum formed; spiracle on ventral side of each segment of connexivum surrounded by red; last segment of male abdomen rounded-up to meet dorsal tergum, dorso-lateral concavities present to accommodate the claspers; last segment of female abdomen rounded at sides and pointed at anterior end; forefemora barred lightly on inner side, heavily on outer side, spotted above and many small bristles below; tibia whitish and with double row of black teeth along inner side; mesothoracic femora barred lightly on inner and outer sides, a few spots above and many small bristles below; metathoracic legs elongated, femora sparsely spotted, tibia lightly spotted and brownish in color; tibia three-jointed and dark at each end.

EXPLANATION OF TABLES

The data submitted in the tables on pages — and — might aid in showing the length of the five instars and the variation which takes place. Only a few specimens are concerned here. They are selected from those nymphs hatching July 4th and July 15th and are those specimens which survived longest.

The first four columns are complete for the time between June 16th and July 15th. The data of the two columns "Laid" and "Hatched" does not necessarily apply as to position in the table, since there was great variation in the length of the incubation period and also since there was much difficulty in marking the new eggs from day to day. The eggs of *N. roseipennis* are very easily discerned but those of *N. rufusculus* were at times barely perceptible.

The number in the sixth column indicates the dish in which one or more nymphs were living and the designation "No." indicates the number of nymphs in a dish.

Even considering the nymphs killed from each instar and preserved, the totals at the bottom of the page show a rather high mortality.

NABIS ROSEIPENNIS

Eggs				NYMPHAL INSTARS											
DATES	LAID	HATCHED		Dish	1		2		3		4		5		Adults
		No.	Dates		No.	Dates	No.	Dates	No.	Dates	No.	Dates			
June 16	17	7	July 4	6a	1	7/9	7/13	1	7/20, 7/22	7/20	1	8/28	1	8/19	
" 17	5	12	" 5	2a	2	7/10	7/14, 7/15	2	7/20, 7/22	7/29	1	7/29	0		
		4a		2b	1	7/11	7/15	0		7/30	0		0		
		2f		2c	1	7/12	7/15	1	7/22	7/30	1	7/30	0		
" 18	20	14	" 6	2h	2	7/12, 7/13	7/16, 7/19	1	7/27	8/14	1	7/29	0		
				2i	2	7/11, 7/12	7/15, 7/16	1	7/22	7/29	1	8/9	0		
				2j	2	7/11, 7/12	7/16	1	7/24	8/9	1		0		
				2k	1	7/12	7/17	1	7/26		0		0		
" 19	16	12	" 7	2l	2	7/13	7/18, 7/19	1	7/25	8/11	1	8/21	0	8/21	1
" 20	10	5	" 8	2m	2	7/14	7/16, 7/19	1	7/23	7/31	1	8/24	0	8/24	1
" 21	3	15	" 9	2n	1	7/13	7/18	2	7/24, 7/25	8/3	1		0		
" 23	6	3	" 10	2p	3	7/15	7/20, 7/23	0		8/19	0		0		
" 24	13	5	" 11	2q	4	7/16	7/21, 7/22	1	7/26, 7/27	8/4, 8/6	2	8/4, 8/6	0		
		1	" 13	2r	2	7/17	7/20	1	7/25	8/7	1	8/4	0		
		3	" 15	2s	2	7/17, 7/18	7/22, 7/23	1	7/27	8/4	1	8/26	1	8/26	1
		3		2u	6		7/22, 7/23	4	7/27, 7/28	8/4, 8/6	3	8/4, 8/6	1	8/27	1
Totals...	90	77			37			22			17		5		5

DATE	JUNE			JULY			AUGUST		
	Maximum temperature	Minimum temperature	Average temperature	Maximum temperature	Minimum temperature	Average temperature	Maximum temperature	Minimum temperature	Average temperature
1.....	74	41	57.5	79	56	67.5	64	43	53.5
2.....	70	34	52		62		67	49	58
3.....	69	57	63	91	62	76.5	69	41	55
4.....				86	62	74	71	44	57.5
5.....				88	66	77	75	42	58.5
6.....	69	63	66	88	72	80	79	53	66
7.....	69	39	54	92	67	79.5	80	61	70.5
8.....	72	41	56.5				76	69	72.5
9.....	77	42	59.5				68	44	56
10.....	81	49	65	91	64	77.5	77	49	63
11.....	80	46	63	80	63	71.5	78	45	61.5
12.....	76	53	64.5	85	64	74.5	76	48	62
13.....	74	47	65.5	79	61	70	74	65	69.5
14.....	71	42	56.5	80	62	71	65	55	60
15.....	65	33	49	82	73	77.5	64	40	52
16.....	67	62	64.5	81	64	72.5	80	41	60.5
17.....	67	48	57.5	73	57	65	71	44	57.5
18.....	70	52	61	74	43	58.5	68	45	56.5
19.....	70	57	63.5	74	61	67.5	70	54	62
20.....	75	38	56.5	74	61	67.5			
21.....	78	69	73.5	75	51	63	75	43	59
22.....	85	50	67.5	77	47	62	65	39	52
23.....	81	60	70.5	80	53	66.5	67	45	56
24.....	74	47	60.5	84	53	68.5	73	49	61
25.....	79	46	62.5	82	57	69.5	75	54	64.5
26.....	80	49	64.5	81	62	71.5	74	49	61.5
27.....	78	51	64.5	84	68	76	76	54	65
28.....	76	60	68	81	58	69.5	70	60	65
29.....	79	63	71	75	51	63	80	60	70
30.....	76	63	69.5	58	43	50.5	77	50	63.5
31.....				73	56	64.5	83	48	65.5

This table shows the temperature changes thru-out the three months of June, July and August.

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Explanation of Plates

1. Portion of grass-stalk showing hatched eggs and egg-caps of *N. rufusculus*, much enlarged.
2. Portion of raspberry stalk dissected showing eggs of *N. roseipennis*, much enlarged.
3. Portion of grass-stalk with protruding white hoods of eggs of *N. roseipennis*, much enlarged.
4. Portion of raspberry stalk showing protruding hoods of eggs of *N. roseipennis*.
5. Dissected stalk of grass showing eggs of *N. rufusculus*, greatly enlarged.
6. Grass-stalk showing hatched eggs and egg-caps of *N. rufusculus*, much enlarged.
7. Distal end of egg of *N. rufusculus* (hatched), showing egg-cap and attachment, much enlarged.
8. Egg of *N. rufusculus*, much enlarged.
9. Dissected grass-stalk showing eggs of *N. roseipennis*, greatly enlarged.
10. Grass-stalk showing hatched eggs and hoods of *N. roseipennis*.
11. Distal end of hatched egg of *N. roseipennis* showing hood and attachment, much enlarged.
12. Egg of *N. roseipennis*, much enlarged.
13. Nymph of *N. roseipennis*, first instar, magnified 35 dia. Body of nymph appears shrunken away from body-wall in some places, probably due to the effect of the preservative. This phenomenon has occurred in a number of cases.
14. Lateral view of nymph of *N. roseipennis*, 1st instar. Magnified 35 dia.
15. Nymph of *N. roseipennis*, beginning 2nd instar. Magnified 15 dia.
16. Nymph, about 4th instar in process of moulting. Magnified about 13 dia.
17. Nymph of *N. roseipennis* beginning 3rd instar. Magnified 15 dia.
18. Nymph of *N. roseipennis* beginning 4th instar. Magnified 14 dia.
19. Nymph of *N. roseipennis* end 4th instar. Magnified 14 dia.
20. Nymph of *N. roseipennis* beginning 5th instar. Magnified 12 dia.
21. Nymph of *N. roseipennis* end of 5th instar. Magnified 12 dia.
22. Mature nabis, *N. roseipennis*. Magnified 11 dia.
23. Nymph of *N. rufusculus*, 1st instar. Body somewhat distorted by alcohol. Magnified 26 dia.
24. Nymph of *N. rufusculus*, end 2nd instar. Magnified 16 dia.
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27. Nymph of *N. rufusculus*, end 5th instar. Magnified 17 dia.
28. Mature nabis, *N. rufusculus*. Magnified 13 dia.
29. Ventral of last segment of female abdomen of *N. roseipennis* showing ovipositor in normal position, also parts dissected. The inner and middle pairs of structures are here shown in approximation. Magnified 13 dia.
30. Ventral view of last segment of female abdomen of *N. rufusculus* showing ovipositor in normal position, also all parts of structure dissected. Magnified 15 dia.
31. Lateral view of posterior of male abdomen of *N. roseipennis*, showing claspers. Magnified 11 dia.
32. Clasper of *N. roseipennis*, from right side. Magnified 56 dia.
33. Lateral view of posterior of male abdomen of *N. rufusculus*, showing claspers. Magnified 11 dia.
34. Clasper of *N. rufusculus*, from right side. Magnified 61 dia.

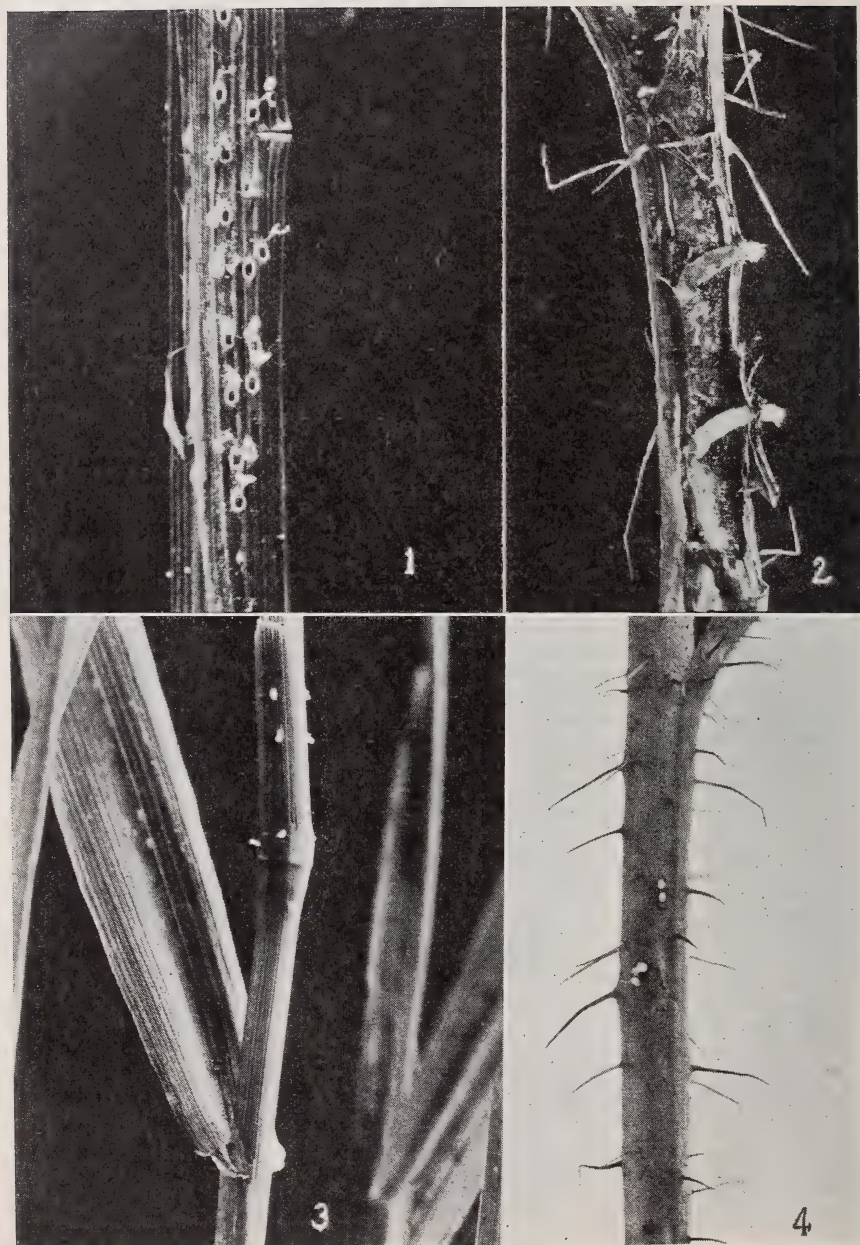
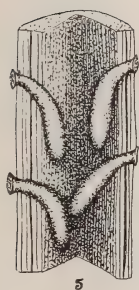
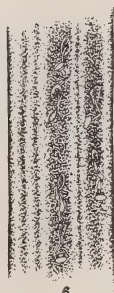


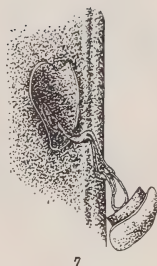
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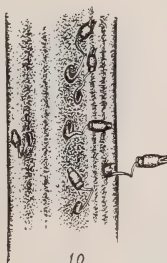
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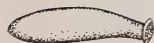
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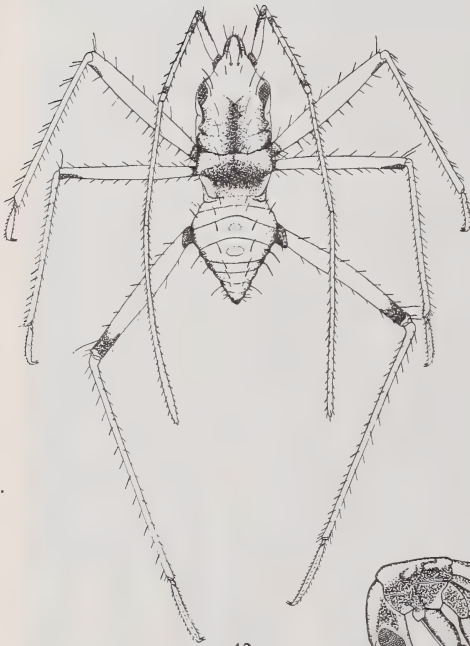


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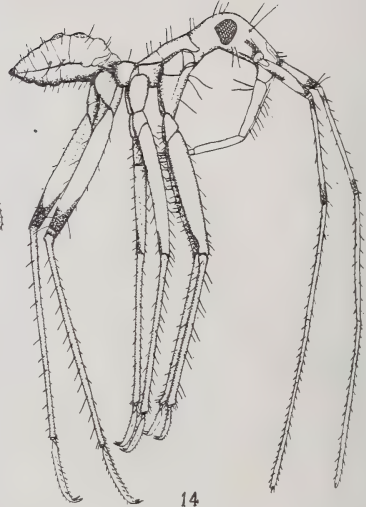


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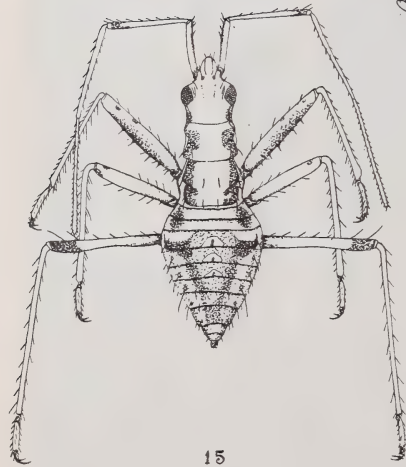
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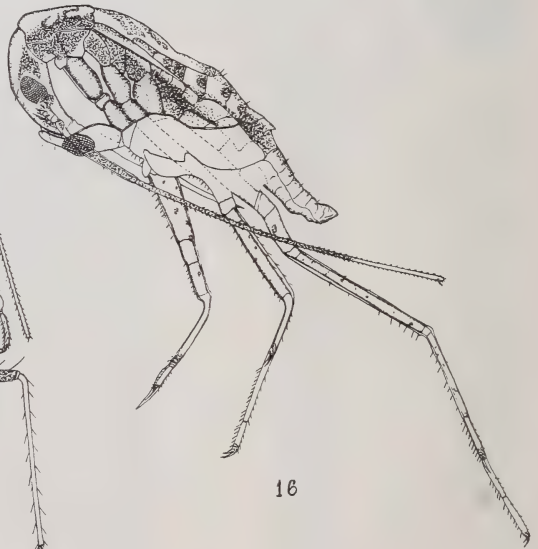
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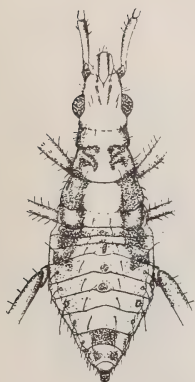


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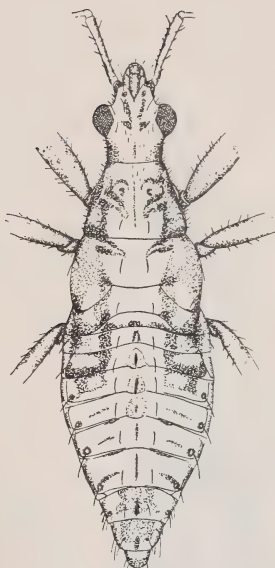


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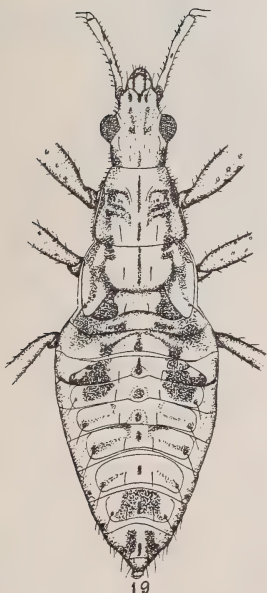
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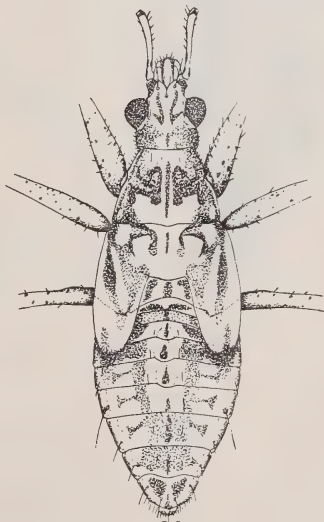
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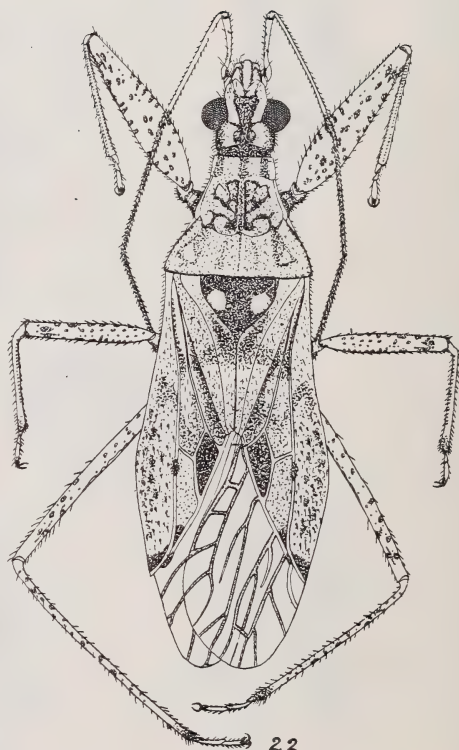
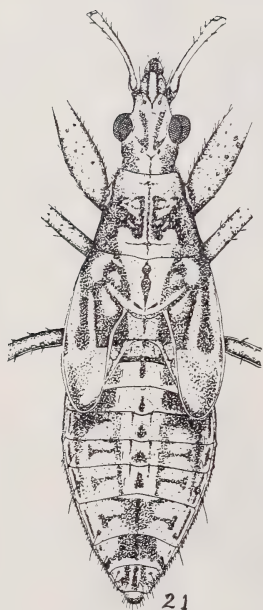
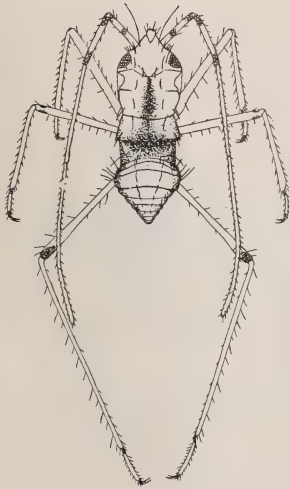
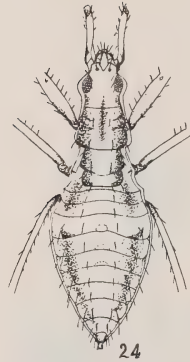


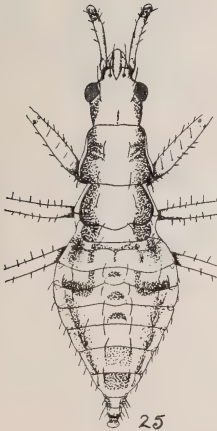
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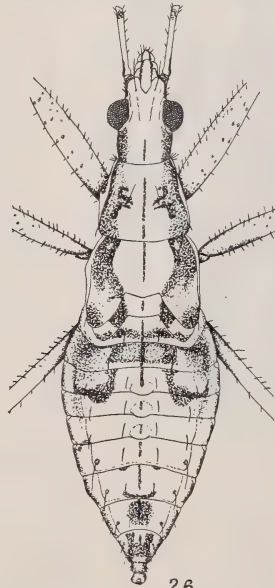
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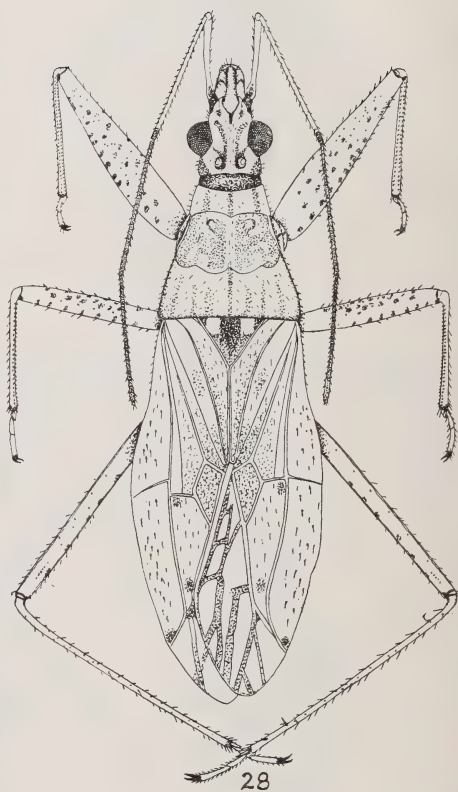
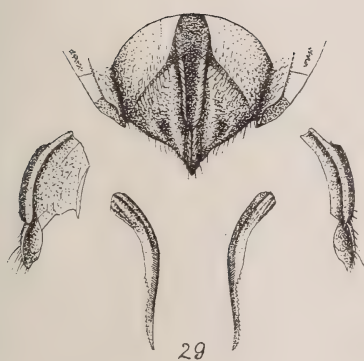
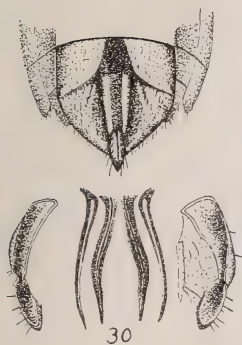


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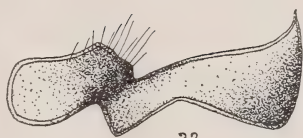
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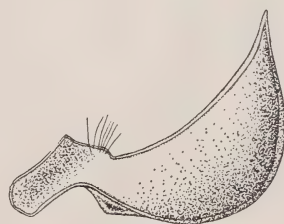
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